THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
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How Is Business?

A Symposium on Business Conditions and Prospects in the Metal Manufacturing and Finishing Industries

A SHORT time ago we sent out a questionnaire to a few leading figures in the industries engaged in the manufacture, reclamation and finishing of metals, asking them briefly for their opinions on the following questions:

1. What is the present situation in your industry?
2. Do you look for improvement in 1930?
3. What do we need to prevent such depressions in the future?

We give below the individual answers to these questions.

From a Manufacturer of Automobile Parts

1. Very poor.
2. Very little.
3. Can't be done.

During a time of prosperity people become extravagant and finally ride to a fall. During a time of depression they practice economy and build up again for the next period of prosperity.

From a Manufacturer of Metal Cleaners

1. Catering to the metal trades as we do, we find that business conditions at present are very bad.
2. Believe that conditions are going to improve and there will be a gradual improvement to the end of 1930.
3. This is a difficult question to answer and we would much rather leave this to the study of economists.

From a Manufacturer of Foundry and Plating Supplies

Of course, much of the depression is due to a psychological cause.

Let us say, in the beginning, that on account of modern machinery the factory output today is so great that we can supply within four years, all that will be consumed in five years and that not only relates to the factory product but to pretty nearly everything, unless it be farm products, about which I know nothing.

Then the old law of supply and demand comes in and there is the lack of demand and the consequent lower price. There are the other things that follow in the trail. The buyer's strike is used in order that nothing shall be purchased unless it be something of actual need. He will not buy a new machine which would be desirable in days of prosperity because it would earn its keep and ought to be more desirable in the days of adversity for the same reason. He cuts down his advertising and economizes wherever he may, so that his overhead will not exceed his net profit. Or, that there may be a net profit instead of a red ink entry.

If advertising is a good thing in days of prosperity, it is a better thing in days of adversity.

We call that psychological but it has a very concrete effect.

For the astute seller of things to make public anything but optimism today, whether he believes it or not, would be asking too much of him.

There are many other things that might be mentioned, that are contributories, such as the new protective tariff bill which has its effect, the bad crops from the extreme drought, and so on. Also, we have had so much optimism in printed opinions, that the hard-hearted business man pays no attention to them now.

From a Manufacturer of Non-Ferrous Ingot Metals

1. Our industry is operating as a whole at about 50 per cent capacity. We have been seriously affected first by the overnight collapse of the price of copper from 18 to 14 cents and the subsequent reduction to below 10 cents.

2. I am looking forward to improvement in the industry in the fall and confidently predict good business for the year 1931. My judgment and optimism are based on the following facts: 1. Bedrock prices at present existing. 2. Depleted stocks. 3. The Hoover program getting into swing. 4. Revival in the building trades due to present lowered costs as compared with last year. 5. World-wide resumption of purchasing. We are now twelve years removed from the war and during that time a firm foundation has been built for long continued peace-time prosperity.

3. The present depression is world-wide, and although the business of the United States is large in proportion to the total world's business, it must be remembered that the United States after all is only a unit of the whole. I believe that the present depression is entirely

due to world-wide conditions. The Federal Reserve System has prevented the old-time money panics. The Hoover recommendation that public improvements and public utility expenditures and expansion should be expedited in periods of depression, namely, in the valleys instead of pyramiding the peaks, I think if followed, would be the most important constructive factor towards stabilizing business conditions within the confines of our own country.

From a Manufacturer of Chemicals

1. Like practically every seller we find far less demand from metal goods manufacturers than existed last year except for articles of highly specialized or newly developing uses.

2. We do not expect any notable improvement during 1930.

3. Under existing economic status, we do not expect that business will always run at constant level.

When business is below the level, everyone calls on his associates, political, business and social, for concerted action to boost. Could depression areas be reduced if concerted action were taken to put on the brakes when business went above the level?

Would anyone consider such a proposition as sane?

From a Manufacturer of Non-Ferrous Ingot Metals

1. Our business at the present time is at a very low rate compared with previous years and follows very generally the average business situation.

2. It is rather generally felt that present prices are at or close to the bottom and that with some improvement likely in price, more business can be expected over the balance of the year.

3. A remedy for depressions such as we have gone through is quite beyond us to suggest.

From a Brass Founder

Since the present business depression is world-wide in its scope, it is more difficult to see what influence or influences will be of major importance in producing a change. Fundamentally, conditions today are, if anything, sounder than they were a year ago, when the crash occurred in the stock market, yet previous to the stock market crash, there was an atmosphere of optimism that produced a buoyancy to business that seemed to be more or less permanent. When the crash came, a general lack of confidence in the future and a widespread feeling of hesitancy followed, which has now become a feeling of almost supercaution.

Some of the lines of business, even under these depressed conditions, are continuing to be active and show profits that are somewhat less than a year ago but in many instances satisfactory. In the non-ferrous foundry business, in particular, business is very "spotty." Some foundries are doing a fair volume of business, although at reduced prices and shrinking profits. It seems to me that the foundries who know their costs through the intelligent use of a sound cost system and who are selling their product at prices based on a knowledge of their cost, if they are quoting prices that are sufficiently above their cost to make a reasonable profit, they will see this period through with substantial gains in the long run.

This is a period when well managed businesses are studying their cost figures, are revising their methods of manufacture in order to lower costs and are improving their equipment toward the same end. Competition, obviously, is at its peak under conditions of this kind and must, therefore, stimulate attention to every detail of the process of manufacture to the end that it may be simplified and reduced to its lowest possible cost.

I look for a gradual revival of business from now on. Since the revival is dependent upon an increase in confidence, it must logically be relatively slow, but the longer this depression lasts, the more active will be the demand when conditions improve, because the depletion of inventories is becoming more and more complete, and the consequent need for renewal of supplies is the more insistent.

From a Brass Manufacturing Company

1. The situation is improving in our industry.
2. We look for further improvement in 1930 and 1931.
3. What we need is more and better brains and a consistent use of them.

From a Manufacturer of Plating Supplies

I consider the fundamental conditions in the country sound. The present depression was caused by stock gambling. Most of the sales on the stock exchange are for gambling purposes, and but a small percentage are legitimate sales. This causes inflated values at times, and this in turn causes more money to be put into the stock market. People turn their minds from business to the stock market, and bankers and others put their money into the stock market instead of legitimate business on account of the much higher interest rate they receive from the stock gamblers.

As mass production depends upon sales to the majority of people it is necessary for the majority to have some surplus from their earnings to purchase the many articles on the market. Eighty per cent of the people receive salaries of $2,000.00 a year or less. When there is a business disturbance people are laid off and purchasing is curtailed through lack of money to purchase.

If some form of insurance could be worked out this would help the unemployed and also assist in keeping up the purchasing power.

Purchasing power is reduced also by many who have the money but are afraid to spend it through fear of unemployment and being out of work for a long period of time. If this fear could be eliminated by some form of insurance, or some surplus, this would help. Also some large users wait until oversupply of raw materials forces prices to lowest point before placing advance orders.

Many employers who have the means could use many more men, having them make needed improvements; also by using as many as possible on part time. Federal and local governments could help by using men for needed improvements particularly in times of depression.

The world wide depression has hurt business. I look for a gradual improvement, and think the worst is over.

From a Manufacturer of Foundry Equipment

I hardly think you want any opinion on the present business situation" because it is obvious to all.

I believe business will not get any worse, but I believe that recovery will be very slow and painful.

We do not anticipate very much increase in volume this year. To date we have passed through the worst business period that this company has ever known in over twenty-one years of experience.

From a Manufacturer of Foundry Furnaces

The less said the better off we'll be. Statements and opinions by public officials and experts have not borne fruit.

We are quoting, going after business, booking some orders and shipping promptly, but all over the country people are not in a buying humor.

From a Manufacturer and Fabricator of Silver

The silverware industry is about 30 per cent behind last year, a good record when compared with other industries.

Summary and Conclusions

THE answers in the above symposium are almost without exception an agreement on the first question. Business is universally poor. On question 2 there is considerable disagreement in that some expect an improvement in 1930 and continued betterment in 1931, while others are either non-committal or skeptical.

The third question, almost unfair to ask, because of its difficulty, and yet necessary because it is the question uppermost in everyone's mind at this time, brought forth some interesting replies. The suggestions included increased expenditure for public improvements, increased expenditure by public utilities, more intensive search for methods of reducing costs, the bolstering up of purchasing power of the mass of the people by unemployment insurance in order to keep up the demand for manufactured products and the retardation of booms by concerted action.

Outstanding Recommendations

Perhaps the most significant of the suggestions given above are the following:

1. The expedition in periods of depression of expenditures for public improvements by the government, public utilities, such as power lines, traction lines, etc., so that these stimulants will come in the valleys instead of pyramiding the peaks of business.
2. Putting on the brakes when business is above its normal healthy level.

Expand in Dull Times

Here are two ideas, different in type, yet both working in the same direction. The first advocates the spending of more money in bad times, while the second recommends the spending of less money in good times. Obviously, the first is important to put into practice as such expenditures can to a considerable extent, be regulated, planned ahead, reserves set up and funds laid aside for such purposes by the Government and the very large corporations. It would be impossible, of course, to restrict all expansion to the periods of depression as the demands of business are often imperative and have to be complied with, without undue delay. For example, it would hardly do for the telephone companies to refuse to increase their facilities until depressions came as these facilities are indispensable when they are needed. Similarly, the expansion of traction lines and railroad equipment cannot always be put off until the next slump. Government expenditures for public works can in some cases, and should be, so distributed as to arrive in the valleys of business.

Hold Back in Good Times

To the suggestion that business be slowed down when it goes beyond a safe rate, there will immediately come the answer that the idea is excellent, but how can it be put into effect? The reason for expansion is a sharp and continued increase in orders. Should these orders be refused after they have reached a certain point? Will the demand thus put off, wait until the materials are obtainable under a "normal" capacity, or will it go elsewhere and attempt its fulfillment from other sources? May not this deferred demand also result in bidding for materials, and consequently inflating prices?

These are not objections; they are only questions. We are confronted today just as we were nine years ago with our too great capacity for producing and manufacturing the necessities and luxuries of human life. Even during the two or three years up to 1929 when business rose to its peak, it was a commonly known fact that profit margins were narrow and that only the best equipped and staffed organizations enjoyed unusual earnings. The middle sized and smaller organizations found their profits less than their turnover and efforts deserved.

It is indisputable that we cannot go on expanding forever. With the increased efficiency of our methods, the steady growth in the use of automatic machinery, and the need for less and less hand labor on the farm and in the shop, our facilities are now sufficient to produce the increasing quantities demanded by our mounting standards of living which have been the main impetus to our expansion. Our problem is to find a way of providing our needs as cheaply as possible, but without over-expanding our facilities and making it impossible to operate profitably except in peak years.

Briefly stated, then, we are confronted with the need for effecting the following results:

1. The production of raw materials and the manufacture of finished products and their distribution at the lowest possible cost in order to place them within the reach of as many consumers as possible, thus keeping the market at its widest and providing volume of consumption.
2. The use to the fullest extent of existing facilities, guarding carefully against overexpansion and overproduction.
3. The maintenance of the highest possible wages consistent with operation at a profit in order to maintain the purchasing power of the large mass of consumers.
4. Agreement upon the principle that it is less harmful to have prices rise under a slight shortage of goods than to provide these goods at a low figure by the use of productive capacity too great for any but extraordinarily busy times. In other words let us figure that our plants should be 90 per cent busy in normal times and perhaps 115 per cent busy (by the aid of night shifts) in boom times instead of 95 per cent in boom times and 50 per cent in depressions. The fact is that in our 1928 and 1929 boom it was always possible to obtain materials for quick delivery. There was plenty of capacity even during the greatest rush without inflation of prices. Would it not have been better if there had been less capacity and perhaps a little price rise, which would slow down the demand gradually before conditions got out of hand?

It is our belief that if brakes of this sort were applied to business which is going ahead too fast, and if added power were applied in the form of stimulated Government and public service construction and expansion in bad times, we should certainly see a smaller difference between our good and bad years.

Tubes Chromium Plated

Q.—I have in operation a generator giving me 500 amperes and 10 volts, which seems insufficient for a 50-gallon crock of chromium solution. Would it be possible to cut the 50 gallons to 25 gallons and still do tubes ¾" in width and 4" long satisfactorily?

A.—You should have no difficulty in plating tubes four inches long and three-quarters inch in diameter with your present solution and generator, providing your solution is in satisfactory operating condition.

Send us a sample of the chromium solution for analysis and we will advise you whether your solution is in proper operating condition.

OLIVER J. SIZELOVE.

Light Weight Alloys in Aircraft Engines

How the Development of Flying Motors Depends Upon Light, Strong Alloys

By E. F. LAKE
Metallurgist

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE latest designs of aircraft engines have relegated iron and steel so far into the background that much the greater of their cubic inches of metal are now composed of light weight metals and alloys. Only twenty-five years ago all parts of internal combustion engines were made of iron and steel, if we except the babbitt metal bearings and any outside trimmings that were made of brass or bronze for decorative purposes. During that period many new discoveries and improvements were made in combining the lighter metals into alloys that could be cast, rolled, forged and heat treated; that were stronger and much tougher than cast

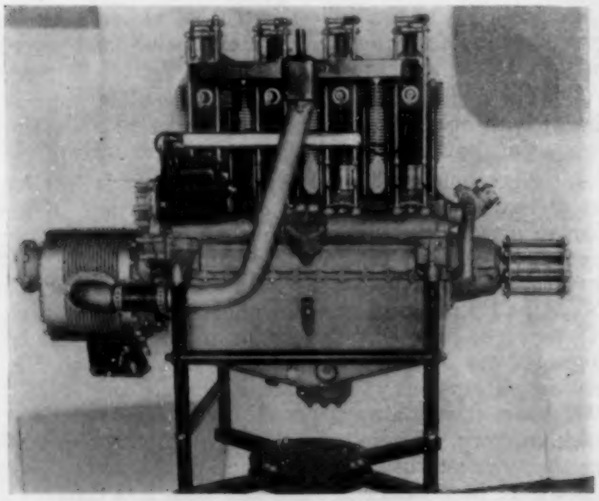


Fig. 1—An Example of the Extensive Use of Light Weight Alloys in Aircraft Engines.

iron; that equalled some of the steels in physical properties, and that could be used in the place of steel at from one-third to one-quarter of the weight. Such developments have not ceased and light metals might still further replace steel parts. These developments were a great boon to aircraft as every reduction in weight added to the pay load that could be carried.

The light weight metals first made their appearance in aluminum alloy castings for both the upper and lower half of the crankcase of automobile engines, in their early days, when each cylinder was a separate and individual casting. When water cooling became the predominating feature of such engines, casting cylinders "en bloc" came into vogue and the upper half of the crankcase was cast in one piece with the cylinders, and of cast iron. This left the less complicated lower half of the crankcase as the only light weight metal on these engines. Many of these are now iron as low cost is of more importance than low weight. During the past five years, however, air cooling became a commercial success on aircraft engines and the cooling fins require an individual casting for each cylinder. This allowed the aluminum alloy that contains four per cent of copper to be used for the upper half of the crankcase as well as the lower half, and a heat treatment was discovered that improved its physical properties.

In Fig. 1 is shown the engine that has made the most out of the light weight alloys and uses them wherever it is possible and practical. It is the new aircraft engine that has just been placed on the market by the American Cirrus Engines, Inc. If we remove such accessories as the magneto and carburetor, the only heavy metal showing will be in the valve springs and that part of the wall of the cylinders that is actually rubbed by the piston rings.

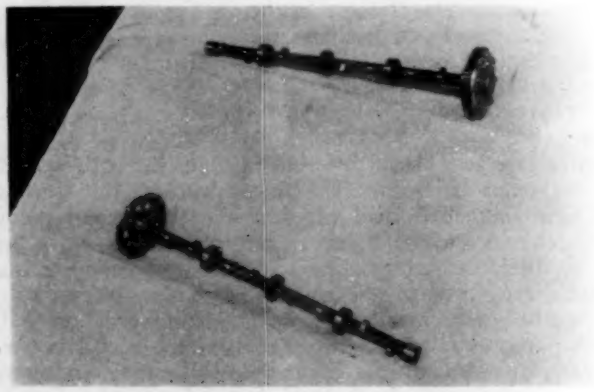


Fig. 2—Cam Shafts Ready for Assembling in an Aircraft Engine.

The intake manifold is welded together from such thin sheet steel that no weight could be saved if it were made from aluminum or any other light metal. On the interior, the only heavy metal parts are the crankshaft, camshaft and gears.

In Fig. 2 is shown the camshaft after it is completely finished with the ball bearings pressed into place and the gear located, ready for the final assembly in the engine. It has to withstand the torsional strains from being driven through the big gear on its end and also the wear on the cams that open and close the valves. For such reasons it is made from the S.A.E. 3140 standard nickel-chromium steel. This big gear is lightened by making it a ring gear and bolting it to a duralumin disk, which forms the web. Recent developments in light weight alloys might enable us to predict that the future may see this whole camshaft made from the lighter metals. The torsional strains are not so great but what they might be withstood by duralumin or some of the magnesium alloys. The stiffness and toughness, if necessary, could be taken care of by a small increase in the diameter and still reduce the weight considerably more than one-half. That leaves the wear on cams as the only factor in which light weight alloys need improvements that will make them the equal of steel.

Duralumin Connecting Rods

In Fig. 3 is shown the duralumin connecting rods assembled on the crankshaft, together with the ball bearings and gear, as this unit is undergoing an oil-flow test just before it is permanently located in the engine and connected to the pistons.

When the correct heat treatment is given these duralumin connecting rods, it is possible to get a tensile strength of 70,000 pounds per square inch, with an elastic limit of 56,000 pounds; an elongation of 15 per cent in 2 inches and a Brinell hardness of 120. This is ample strength for rods of this size and they have never shown any signs of failure when in actual service. If the very best grade of the high nickel-chromium steels were used, physical properties that are three times as high can be obtained. That would mean that duralumin rods would have to be made three times as thick to get the same total strength of rod. As duralumin is about one-third the weight of steel, that would equalize the weight of finished rods of either steel or duralumin. This is the highest priced of all the grades of steel, however, and it is very hard to machine. Machining all over has been resorted to to get such steel rods down to the total strength needed and that left the shank so thin it would spring under load. For forging reasons or because of this springiness, the steel rod might have to be made thicker than its strength warrants and that would make the duralumin rod the lightest. The ease with which duralumin can be machined makes their cost much less than that of rods made from this high grade steel. When cheaper steels are used, with lower physical properties, the duralumin rods can be made with about one-half of their weight. Then again, duralumin forgings have a much smoother surface and are more accurate to size than are steel forgings. Thus they do not vary enough in weight to need holes drilled for balancing and present a much better appearance. All of which makes duralumin connecting rods compare favorably in cost with even the cheaper steels and they have the advantage of considerably less weight.

Crankshafts

The crankshaft has to withstand such severe strains and stresses of a tensile, torsional and vibratory nature, that it must be made of steel and the high grade alloy steels are the usual choice. In this case it is a medium nickel-chromium steel of about the following composition: Nickel 1.75%; chromium 0.75%; carbon 0.40%; manganese 0.60%; silicon below 0.10%; sulphur and phosphorus below 0.02%. We might say, it will be impossible to make this crankshaft of any light weight alloy, but who can tell what the future will bring forth? Less than thirty years ago we could have said "it will be impossible" about many things of a metallurgical nature that are now in use. A steel that will not rust we thought impossible as late as 1910. As late as 1912, a prominent engineer of the General Electric Company told me it was impossible to design an instrument that would automatically throw the current on and off of an electric heat treating furnace and automatically maintain an accurate temperature. In spite of the reasons he gave for this being impossible, such instruments were in commercial use within five years. These are mere samples of many things that could be mentioned. Aluminum alloys have been greatly improved within the past twenty years; heat treatments have been discovered for light weight alloys; magnesium alloys have been commercialized, and much experimental work is being done with beryllium, lithium and other light materials. If the future rate of progress only equals that of the past, a light weight alloy might be discovered that would even take the place of steel for crankshafts.

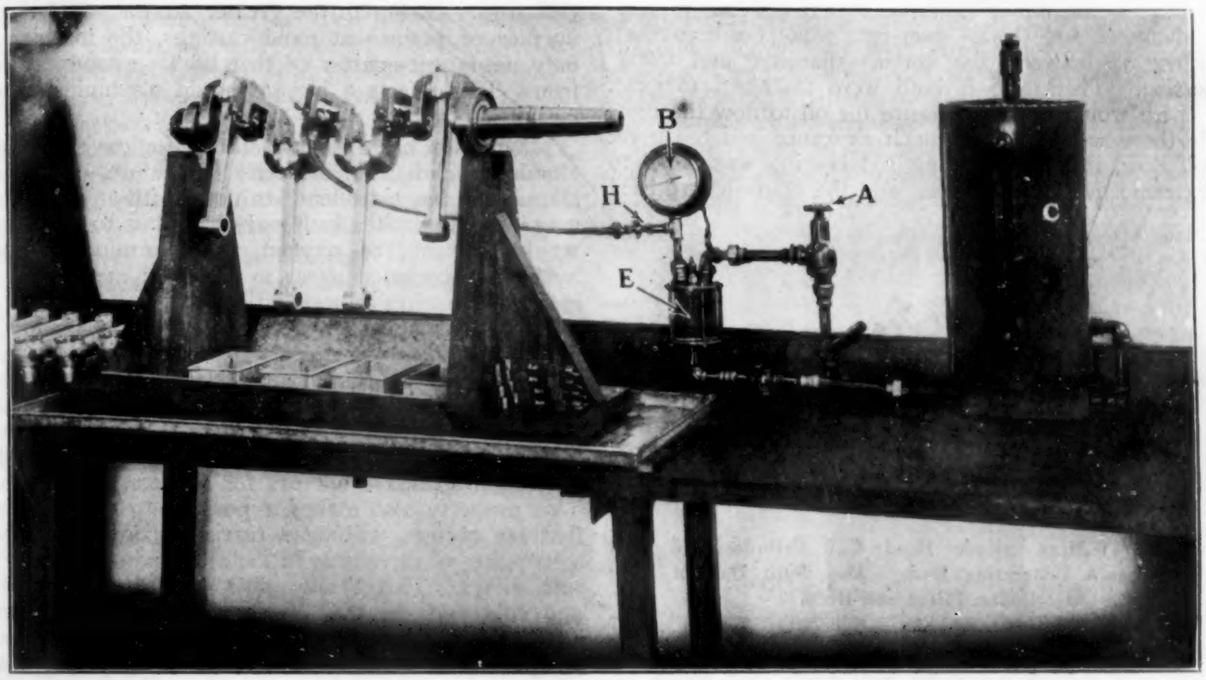


Fig. 3—Crankshaft and Duralumin Connecting Rods Receiving the Oil Flow Test Just Before Final Assembly of Engine.

Oil Flow Test

The lighter metals need lubrication as well as those that are heavy and this oil-flow test, or inspection, is interesting in that it is very simple and yet effective, and duplicates the working conditions of the connecting rods on the crankshaft when the engine is running. A uniform oil flow of sufficient volume is of extreme importance on aircraft engines, as a burnt-out bearing, or one that stuck,

might cause a fatal crash. If this happens on an automobile you can walk to the nearest garage but when it occurs on an airship you are just out of luck.

In operating this device, the first thing is to see that a sufficient quantity of oil enters oil cup E from storage tank C and yet enough space is left for the air pressure. Then valve A is opened just enough to enable the shop air compressor to deliver to oil cup E the amount of air that will register a 55 pressure on dial indicator B. After that, pet cock H is opened to allow the oil to flow to the connecting rod bearings. The result will be an oil drip from each bearing to the pan that is underneath. This unit is ready for its final assembly in the engine when the oil falling into the pans is the correct number of drops per minute and when each bearing delivers an equal number per minute.

The oil flow is governed by the clearance between the connecting rod bearing and the crankshaft. These bearings have a machining tolerance that is between the correct diameter and 0.002" oversize; while the crankshaft tolerance is between the correct diameter and 0.002" undersize. Therefore, if both were machined to exact size there would be no clearance for oil to flow through; while there would be too much clearance and too great an oil flow, if the connecting rod bearing was bored to its extreme oversize diameter, and the crankshaft turned

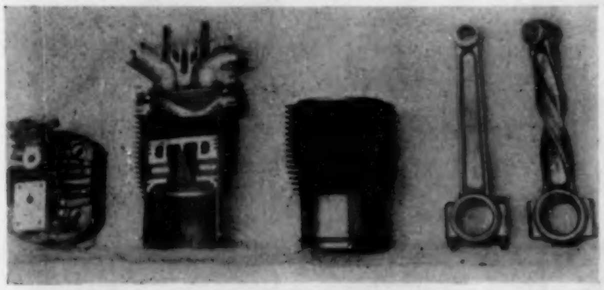


Fig. 4—Y-Alloy Cylinder Head; C. I. Cylinder; and Duralumin Connecting Rods. Also, Split Half of Cylinder, Piston and Head.

to its extreme undersize diameter. This makes the work consist of matching up rods and shafts and changing them until there is just 0.002" clearance between each crankshaft bearing and its respective connecting rod. The oil-flow shows this, as each bearing will then drip an equal number of oil drops, and the oil pump pressure will deliver the correct number of drops per minute.

Y-Alloy Cylinder Head

In Fig. 4 is shown a better view of a finished duralumin connecting rod, together with a rough forging that was twisted to get the torsional stress. To the left is shown one of the most interesting parts of this engine, in that, this is the first time such a large and complicated piece as this cylinder head, was cast in a permanent mold from the Y-alloy that was developed in England. This was made possible by using two dry sand cores for the two valve openings. The piston is also a Y-alloy, permanent mold, casting that uses a dry sand core for the center. One-half of the piston is shown within the split half of the cast iron cylinder and a split half of the cylinder head is on top of that.

The Y-alloy was produced by adding 2.00 per cent of nickel and 1.50 per cent of magnesium to the aluminum alloy containing 4.00 per cent of copper. The nickel reduced the crystalline structure found in aluminum-copper alloys and densified the grain enough to raise the tensile properties of sand castings some 20 per cent. Casting in permanent molds chills the metal and densifies the grain enough more to add another 20 per cent to the strength of the alloy. The nickel also made the alloy susceptible to a heat treatment that increased the physical properties some 50 per cent.

Many times there has been obtained a tensile strength of 55,000 pounds per square inch; an elastic limit of 30,000 pounds, an elongation of 5 per cent in 2 inches, and a Brinell hardness of 100. As compared with the "nil" elongation of cast iron, and an elastic limit that is not obtainable, this alloy has considerable toughness and the tensile properties are practically double those of iron castings of the best grades for cylinders. Therefore, the cylinder head walls can be made thinner than when iron is used and the internal heat can be radiated away in less time. That makes their weight about one-third of what cast iron cylinder heads would be and their toughness prevents the blow-outs that sometimes occur with cast iron. Owing to the greater accuracy and smoother surface of permanent mold castings, the machine finish only needs one-quarter of that used on sand castings of iron. This effects a big saving in machining time and cutting tools.

Magnesium has a greater affinity for oxygen than does aluminum and it is lighter. Therefore, some of the magnesium has a tendency to unite with any oxygen that may be in the molten bath and carry it up to the slag. This would prevent the oxygen from forming microscopic bubbles or occluded gases in the solid metal and would increase the physical properties just to that extent. Its greatest mission, however, is to make this Y-alloy much more resistant to corrosion than any of the aluminum alloys that do not contain magnesium. At the same time it increases the plasticity to an extent that makes machine tools cut much easier and leave a very smooth surface. These surfaces can be given such a bright polish that they made non-breakable mirrors for soldiers in the late war. This property also makes it possible to cut fine threads that are perfect, without a tearing up of the metal and a stripping of threads as in the aluminum-copper or other such alloys. This Y-alloy also stands extremes of heat and cold and the 600 F. degrees of heat encountered in the combustion chamber, or the cold met with in climbing over mountains do not weaken it to any extent, or cause warpage or cracks to develop.

Properties like the above make it possible to increase machine speeds more than four times over those used on cast iron cylinders and still get smoother surfaces with one cut than can be produced on iron with a roughing and a finishing cut. Cutting tools also leave smooth enough surfaces to make grinding operations unnecessary. When all such items are figured up, the cost of Y-alloy cylinder heads figures very favorably with those made from cast iron and the greater toughness relieves the fear of blow-outs; while the greater yield point and fatigue resistance are very decided advantages.

The cylinder, as shown in the center of Fig. 4, is an iron casting because no metal or alloy has yet been discovered that will glaze over and resist the abrasive wear from the rub of piston rings for as long a time as will cast iron. All kinds of carbon and alloy steels have been tried but they wear out quicker; score easier, and have a tendency to warp from the heat inside the engine cylinders. Light weight alloys, or any of the non-ferrous metals have not yet shown an ability to resist such wear as long as even the steels did, and cast iron doubles that. If a light weight alloy should be developed that would withstand this abrasive wear, it would remove the last piece of heavy metal on the outside of this engine, except for valve springs and bolts.

Magnesium Alloys

Magnesium base alloys are 38 per cent lighter than this Y-alloy and show indications of being a competitor. At present, however, they have a tendency to corrode and their tensile strengths are lower. They also lose considerably more of their physical properties than does the Y-alloy, when subjected to the combustion chamber heat of 600 degrees F. That would require cylinder heads with thicker walls to hold in check the forces produced by gas exploding in the combustion chamber, and the saving in weight would be lost. The higher thermal conductivity of the magnesium alloys is a decided advantage, however, and so much experimental work is being done that bad features like those above may be overcome. One alloy was produced that contained 11 per cent of copper and equalled the physical properties of the Y-alloy when heated to 600 degrees F. But the weight of the magnesium-aluminum alloy of 113 pounds per cubic foot, was increased to 158 pounds by the copper. As compared with the 185 pounds per cubic foot of the Y-alloy, the weight saved on this cylinder head would hardly be sufficient to pay the higher prices of magnesium base alloys. Recent developments give promise of lower prices for such magnesium alloys as soon as they are used in large enough quantities. Then they might enter into competition if corrosion is reduced. At present, however, practical results are best obtained with Y-alloys.

Silicon increases the resistance to corrosion of the aluminum alloys; raises the elongation, and lowers the specific gravity. But, it must be kept out of these alloys because it decidedly lowers their elastic limit. Resistance to corrosion is also increased by manganese and as high as 0.35 per cent can be allowed, but more than that is injurious to physical properties.

Supercharger

To the left of Fig. 1 is shown the first of the De Palma superchargers. It is shown here because the Y-alloy was considered best for all of its parts on account of good physical properties, in conjunction with lightness. In one test it raised the horse power of this engine to 124; while the rating, without supercharger, is 95 H.P., at 2100 r.p.m.

On his racing cars, Ralph De Palma discovered that the figure 8 pump made an ideal supercharger when it was run at the correct speed and had extremely small clearances between the two figure 8's and their case. Then the American Cirrus Engines, Inc., took over its manufacture on a commercial basis. The parts consist of the two figure 8's on the inside; the outer case with its cooling fins; the end covers; the discharge elbow, and the flanged connection. As the Y-alloy casts well in permanent molds, they were used for all of these parts because of the accuracy to size, smooth surfaces and small amount of finish that need be allowed for machining. The supercharger takes the gas from the carburetor (the bottom of which shows black underneath the supercharger) and churns it enough to break up any gasoline globules that may be present and delivers to the engine cylinders a finely atomized spray that is under the correct compression for the best results. The job is completed with an aluminum pipe that conveys the gas to the intake manifold and the result is a very light engine with a greater strength and toughness than when such engine parts are made from cast iron.

Spotted Silver Plate

Q.—I am sending you a sample of silver solution, soda potash cleaner, and sample of work plated and lacquered. You will notice the piece of plated metal is spotted. These white spots appear after lacquering as well as before. My process is as follows:

Metal is stamped; rubbed down with pumice; washed; dipped in potash and soda cleaner; placed in silver strike; placed in silver plating bath; scratchbrushed; rubbed down with pumice to remove any small pit holes; washed; run through alchohol; rumbled in sawdust; lacquered.

We use 6 volts; there is a rheostat on each tank and we use a voltmeter.

A.—Analysis of silver solution:

Metallic silver	1.15 oz.
Free cyanide	3.01 oz.

Analysis shows that the metal content of this solution is quite low and the free cyanide content too high for the metal content. We suggest that you add to this solution one ounce of silver cyanide and one ounce of sodium cyanide for each gallon.

The spots that are on the sample piece of silver plated work are known as stain spots and are caused by the porosity of the base metal. The only suggestion that we have to offer to overcome some of the trouble is to wet scratchbrush the work, using a crimped steel wire wheel and soap bark in the water as a lubricant, before the pumice operation. Also, check the quality of the lacquer that is being used on the work.—Oliver J. Sizelove.

"Silver Galvano" Method

Q.—We manufacture metal work for church use. Some time ago a member of our firm returned from Europe and reported to us a process of making small medallions known as the "silver galvano" method. The medallions are used on the bases of chalices. It seems the method is to deposit silver on a wax base. Can you tell us how to operate this method?

A.—Undoubtedly the "silver galvano" method is similar to the method of producing a copper galvano. We suggest that the following method be used:

The wax molds are made conductive by first applying a coat of finely divided graphite, or "black lead" as it is usually termed, and brushing the excess off with a soft camel hair brush. After "black leading" the articles are "oxidized" by treatment with copper sulphate and iron filings.

A dilute, slightly acid solution of copper sulphate is poured on the graphited surface and then fine iron filings are sifted over it and the surface brushed gently until completely covered with copper. After the article is covered with copper, rinse thoroughly in clean cold water and pass through a mercury dip and then place in regular silver solution. The silver solution should contain from 4 to 5 ounces of metallic silver and 1 to 2 ounces of free cyanide to the gallon. Operate the solution with a low cathode current density—1 to 2 amperes per square foot.

Oliver J. Sizelove.

White Metals, Brasses and Bronzes

A Series of Articles Describing the Types, Constituents, Properties and Methods of Making a Wide Variety of Mixtures as Practiced in a Large Casting Plant—Part 8, Conclusion*

By E. PERRY
Consulting Chemist, Oakland, Cal.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

FUSIBLE alloys are used for boiler-plugs, sprinkler valves, etc., and are made of metals with a low melting point. All of the metals may be melted together at once, or the lead melted first and the bismuth, tin, cadmium, zinc, etc., may be added afterwards.

These alloys are formulated to secure definite "melting points" for specific purposes. The following table will include only sufficient number of combinations as will illustrate the variations in melting points which can be obtained over a very wide range. The complete table would show steps of 5 to 10°F., but a table of that scope is hardly necessary in the present instance:

Melting Point	Tin	Lead	Bismuth	Cadmium	Zinc	Antimony	Copper
160° F.	19.97	19.36	47.38	13.29	....	....	....
187° F.	50.00	25.00	....	25.00	....	....	....
200° F.	25.00	25.00	50.00	....	....	....	....
240° F.	40.00	10.00	50.00	....	....	....	....
304° F.	45.46	36.36	18.18	....	....	....	....
360° F.	66.67	33.33	....	....	....	....	....
410° F.	45.60	54.40	....	....	....	....	....
457° F.	90.00	....	....	....	....	10.00	....
464° F.	....	90.00	....	....	....	10.00	....
475° F.	33.34	66.66	....	....	....	....	....
518° F.	22.10	77.90	....	....	....	....	....
560° F.	12.00	88.00	....	....	....	....	....
1472° F.	20.00	....	....	....	....	....	80.00
1650° F.	10.00	....	....	....	....	....	90.00
1742° F.	....	....	....	....	40.00	....	60.00
1868° F.	....	....	....	....	20.00	....	80.00

Solders and Brazing Compounds

In hard solders and brazing metals containing copper, gold, silver, aluminum, lead, tin, bismuth, zinc, etc., the copper is melted first and the other metals added in the order named. The metal with the highest melting point is generally the least volatile and is the one usually melted first. Bismuth is somewhat volatile and zinc extremely so, therefore these two metals are always added last.

The method of making soft solder is as follows: the lead is first melted, or both the lead and tin are melted together in an iron kettle fitted with a gas-jet, the burning gas being allowed to play on the surface of the metal. As the gas keeps the air away from the surface of the molten metal there is little or no oxidation, and by stirring with a pine stick a thin coating of charcoal gradually forms on the surface of the metal, still further protecting it from oxidation.

Soft Solders are typified in the following examples:

	Tin	Lead	Bismuth
Tinners' Fine Solder, melts . .340° F.	66.67	33.33	....
Tinners' Soft Solder, melts....334° F.	60.00	40.00	....
"Half and Half" Solder, melts..370° F.	50.00	50.00	....
Low M. P. Solder, melts......202° F.	27.27	45.45	27.28
Plumbers' Coarse Solder	25.00	75.00	....
Soft Solder for Pewter	37.50	50.00	12.50
Fine Pewter Solder	40.00	20.00	40.00

"Half and Half" is a standard grade, and large users buy this on specification to insure a uniform grade of metal of known purity, therefore the composition of the solder must be strictly within the limits specified. The alloy must be free from oxide, dross and foreign metals, such as antimony, arsenic, aluminum, copper, iron, and zinc. Pure tin and refined lead must be used in making this grade of material, as it is absolutely necessary that the solder flow freely under the soldering copper. In tolerance, tin must not be less than 49.00 per cent, and lead must not be more than 51.00 per cent; and preference in every case will be given material containing the full 50.00 per cent of tin. Alloy containing more than 0.10 per cent of arsenic, antimony, or copper; or more than 0.05 per cent of aluminum, iron, or zinc, may not be accepted. Material made according to these specifications will have a specific gravity of 8.660 to 8.800, and a cubic inch of the metal will weigh 5 ounces. The melting point will be about 370°F., and the solidifying point about 340°F.

"Fine solder" is composed of 2 parts of tin and 1 part of lead. It has a specific gravity of 8.180 to 8.320; a melting point of about 340° F., and solidifying at about 300°F.

"Coarse, or plumbers' solder" is composed of 1 part of tin and 2 parts of lead; its specific gravity ranges from 9.180 to 9.360; melting point 441°F., and solidifying point 400°F.

The lowest melting point of the tin and lead solders is obtained with a mixture consisting of 3 parts of tin to 2 parts of lead, the melting point being 334°F. The injurious elements in solder are arsenic, antimony, copper, and iron which act as hardeners. Aluminum and zinc have a tendency to form oxides, consequently impair the free flowing quality and also prevent the solder adhering to the work.

Hard solders and brazing metal are of different kinds; a few examples are given in the table at the top of the next page.

*Parts 1 to 7 appeared in our issues of September, November and December, 1929, and February, May, August and October, 1930, respectively.

TABLE OF HARD SOLDERS AND BRAZING METALS

	Copper	Zinc	Tin	Yel. Brass	
Easily Fusible Silver Solder	46.20	15.30	....	....	38.50 Silver
Hard Solder for Brass	48.00	48.00	4.00	....	....
German Silver Solder	36.00	56.00	....	....	8.00 Nickel
Common Soft Silver Solder	33.33	16.67	....	....	50.00 Silver
Solder for Brazing Steel	4.55	....	....	9.10	86.35 Silver
Easily Fusible Gray Solder	44.00	50.00	4.00	....	2.00 Lead

Fluxes for Soldering and Brazing

The following table gives the kind of solder to be used on the different metals, and the proper flux:

MATERIAL TO BE SOLDERED		
Tin	"Half and Half" Solder	Rosin, or $ZnCl_2$
Lead	Coarse, Soft Solder	Rosin, or Tallow
Pewter and Britannia	Fusible Solder	Rosin, or $ZnCl_2$
Brass, Copper, Zinc, Iron	Coarse, Soft Solder	Zinc Chloride
Brass	Brass Solder	Borax
Copper and Iron	Brazing Metal	Borax
Brass, Copper, Iron, Steel	Silver Brazing Metal	Boric Acid
Silver	Silver Solder	Boric Acid
German Silver	German Silver Solder	Boric Acid

Tin, brass, and iron are generally fluxed with zinc chloride ($ZnCl_2$) soldering fluid, previous to soldering. This fluid is made by dissolving metallic zinc in muriatic acid. The following recipe should be used because it eliminates the small quantity of iron usually present in metallic zinc, viz.: Dissolve 1½ lbs. or more of metallic zinc (spelter) in 1 gallon (10 lbs.) of hydrochloric (muriatic) acid, the object being to add zinc in excess or until the acid will not dissolve any more metal. When so saturated, filter or decant the clear solution into a clean earthenware jar, and throw in about 2 ounces of zinc oxide. Stir well and then allow to stand for a day or two, by which time the iron will be precipitated as iron oxide on the bottom of the jar. Filter the solution, and then add 4 ounces of ammonium chloride (sal-ammoniac) previously dissolved in 1 quart of soft water. To still further improve this soldering fluid, add 1 quart of "tin solution" made by dissolving 4 ounces of stannous chloride in dilute muriatic acid, i.e.—1 pint of acid mixed with 1 pint of soft water.

The flux used by plumbers for "wiped joints" is stearic acid, tallow, sweet oil, or rosin, separately or mixed together.

One of the best all-around fluxes for soft soldering is made as follows: melt together 8 ounces (½ lb.) of beef tallow and 1 fluid ounce of sweet oil (olive oil), let cool, then triturate in a mortar with 4 ounces of dry zinc chloride, after which add 48 ounces (3 lbs.) of powdered tin, and again triturate.

Nickel Silver Mixtures

Nickel is the principal constituent in nickel (German) silver, and if the resultant metal is to be white in color at least 20.00 per cent of nickel must be present. In charging the crucibles it is customary to place a layer of copper on the bottom, followed with a layer of zinc and nickel, using about one-third the total weight of metal, thereby having three such layers. If preferred, however, the copper and nickel may be melted together, and the zinc and other metals then introduced. A coke-dust or charcoal cover is generally used on top of the melted copper and nickel previous to adding the zinc, etc. The metals should be melted quickly and poured very hot because German silver is very susceptible to blow-holes. The molds are generally given a "black wash" consisting of lamp black in turpentine mixed to brush consistency, then skin-dried with the torch or allowed to dry naturally. Oxides in the molten metal are removed by throwing "pitch-balls" (coke-dust made into balls with pitch) into the molten metal and pushing them down with a dry pine or birch stick.

Some nickel silver mixtures are shown in the following table:

	Copper	Zinc	Nickel	Tin	Lead
Common German Silver	55.00	25.00	20.00	.....	.....
Yellow, Ductile	62.50	31.20	6.30	.....	.....
Malleable	60.00	20.00	20.00	.....	.....
Spoon Metal	69.80	5.50	19.80	4.90	.....
Soft Casting Metal	48.50	24.30	24.30	.....	2.90
Hard Casting Metal	58.30	19.40	19.40	.....	2.90

Concluding Remarks

The making of brass and bronze from new metals is comparatively easy, but economy in the brass foundry requires that all of the sprue must be worked up, also that the ash-metal (skimmings) be utilized. Furthermore, the brass and bronze borings from the machine shop should be used, consequently if economy is to be practiced then the greater part of the alloys turned out will be "scrap mixtures," and it will be found to be a difficult matter in such cases to keep the product uniform. Of course, sprue is classed as new metal providing that the sand and dirt are removed before remelting, but it is generally deficient in zinc due to loss in melting, which may amount to 2.50 per cent, therefore in remelting sprue about 2.00 per cent more of zinc must be added to the mixture. In the bronze or copper-tin alloys there is usually a loss of about 0.50 per cent of tin, and this must be made up by adding that much more tin to the remelt. If free from iron, and the different grades have been kept separate, borings may be used like sprue and will not cause any trouble. Bushings and important castings should be made of new metal and sprue only, but secondary bearings and machinery castings may include borings in the mixture. In no event should bushings and important castings contain more than 50.00 per cent of scrap, and secondary castings should not contain over 75.00 per cent of scrap. In all mixtures containing scrap (sprue and borings), a certain amount of phosphor-copper should be added to deoxidize the mixture, usually 2 to 4 ounces of phosphor-copper to every 100 pounds of the alloy. "Ash-metal" or skimmings should not be charged direct even in cheap brass mixtures, but after cleaning should be melted under a cover of sal-ammoniac and charcoal, and poured into ingots. Ash-metal consists mostly of oxides, and when charged direct diffuses the oxide throughout the entire charge, resulting in spongy and brittle castings.

To refine ash-metal it is necessary in remelting to add a de-oxidizer, either phosphor-copper or silicon-copper; about 2 pounds of phosphor-copper being required to refine 100 pounds of ash-metal. Even after refining there is a large amount of dirt, sand, and dross on the surface of the melt which must be removed, and this second skimming should not be used again as there is seldom enough metal in it to pay for the cleaning.

Smelting Secondary Aluminum and Aluminum Alloys

A Series of Articles on the Reclamation of All Forms of Scrap and Used Aluminum and Aluminum Alloys. Part 10—Miscellaneous Equipment and Tools.*

By DR. ROBERT J. ANDERSON
Consulting Metallurgical Engineer, Cleveland, Ohio

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

In previous articles in this series, certain equipment used in secondary aluminum practice has been discussed, including appliances used in the pre-treatment of scrap and furnaces employed in re-melting operations. In this article, consideration is given to other equipment required in the secondary aluminum plant, including ladles and pouring appliances, molds, furnace tools, and pyrometers. Miscellaneous equipment as used in different plants in the industry varies considerably as to design, and no attempt can be made here to describe all the kinds of molds, ladles, or tools that have found application. Rather, the general type of equipment will be discussed, and illustrations will

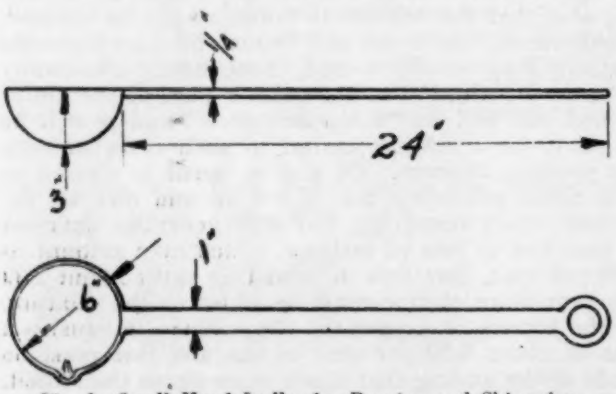


Fig. 1—Small Hand Ladle, for Pouring and Skimming.

be given of appliances that have been used in some plants and found satisfactory. Most secondary operators have designed their own molds and furnace tools.

After the re-melting operation, the metal is transferred from the furnace to molds, being poured into pigs of various sizes. Pouring is done by hand, and the metal may be carried in crucibles or ladles by hand to the mold line-up. In tonnage plants, it is usual to employ light cranes or overhead mono-rail for the transfer of metal from the furnace to the molds. After the pigs have cooled sufficiently in the molds, they are removed and may be stacked on steel skids, being then transferred to stores by electric trucks. The handling equipment employed depends upon the amount of metal turned out, very crude appliances being used in some small plants. There is ample scope for mechanization of metal pouring and pig handling in the secondary aluminum industry. However, the larger smelters have been adopting various devices that reduce hand labor and speed up operations.

Owing to the attack of cast iron and steel by liquid aluminum, tools and various appliances used in the plant wear out rather rapidly. In a large smelter, it is advisable to have a small heavy repair shop as an adjunct. This may be provided with a blacksmith's forge, welding equipment, drill press, lathe and pipe-cutting tools. Pouring shanks, furnace tools, and other equipment can be readily made and repaired in such a shop. It is important that all equipment be kept in good repair. Maintenance and replacement costs can be lowered and accidents in the plant reduced by proper and timely attention to the condition of appliances used.

Heavy castings, e. g., molds, are usually procured from a nearby iron foundry, while steel shapes, pipe, fittings, and other minor supplies are purchased from the regular sources. A small stock of the usual items required in repairs and maintenance should be carried in the repair shop.

Pouring Appliances

In small-scale work, e. g., when using stationary iron pot furnaces, the metal may be dipped out of the pot by hand ladles and poured into the molds. Where tilting

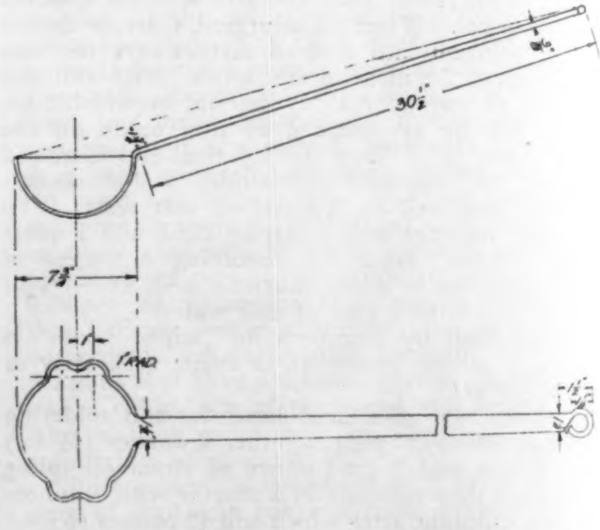


Fig. 2—Hand Ladle with Double Lip on Either Side.

furnaces of small capacity are employed, the metal may be run out into pouring crucibles holding about 100 pounds and carried to the molds. In large-scale work, e. g., where metal is run in open-flame stationary hearth-type furnaces of say 20,000 pounds capacity, it is advisable to provide mechanical pouring equipment. Convenient equipment for large-scale work consists of a tilting bull ladle of about 500-pounds capacity for holding the metal together with a small electric hoist mounted on a light overhead crane. The crane may be operated manually. In some large plants, metal is tapped from large stationary hearth furnaces of 10,000 to 20,000-pounds capacity into carrying crucibles (100 to 200 pounds) and transferred to the mold line-up either by hand or by overhead mono-rail.

Small hand ladles are used considerably in secondary

* Parts 1, 2, 3, 4, 5, 6, 7, 8, and 9 were published in our issues of January, 1925; September, 1925; February, 1926; May, 1926; November, 1926; July, 1927; November, 1927; August, 1928, and October, 1929, respectively.

practice for such purposes as skimming, pouring, and taking dip samples. Such ladles are often made of pressed steel. They are shaped like a shallow bowl. Handles are of various lengths. Preferably, the bowl should be made of grey cast iron since this material has much longer life than steel. Cast-iron ladles have the disadvantage of being heavy. Fig. 1 is a sketch of a small hand ladle. Fig. 2 shows a ladle with a double lip on either side of the bowl. This ladle is used in pouring two 1-pound notch bars at a time. Ladles are also shown in Fig. 8. (*cf.* the fifth, sixth, and seventh objects in the photograph).

Plumbago crucibles are used considerably for pouring. The usual size is from No. 100 to 200, holding about 100

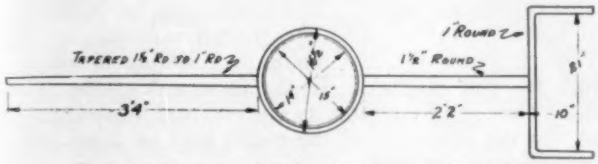


Fig. 3—Carrying Shank for No. 150 Crucible.

to 200 pounds of liquid aluminum, respectively. Such crucibles are mounted in a carrying shank, the latter being carried by a hook which is attached to a chain hoist. Fig. 3 is a sketch of a shank for a No. 150 crucible and Fig. 4 shows a shank hook. Crucibles have fairly satisfactory life when used for pouring aluminum and aluminum alloys. Pouring ladles holding about 50 to 200 pounds of metal, made of steel and lined with a suitable refractory (fire clay or high temperature cement) are also used. These are made with a pouring lip. They are handled with shanks in the same way as crucibles.

Tilting bull ladles are very convenient for pouring and are conducive to rapid and easy operation. The writer has used tilting bull ladles having capacities of 300 to 6,000 pounds. The large sizes require operation from overhead electric cranes and have the disadvantage that the metal may freeze in the bottom before pouring is complete. They are also cumbersome to operate. Bull ladles holding 500 to 1,000 pounds of metal work well. These ladles are made of steel boiler plate and lined with a refractory layer to prevent contact of the liquid aluminum with the steel. They are equipped with suitable mechanism for tilting. Handling is from overhead mono-rail with a chain hoist or from light manually-operated overhead crane with an electric hoist. Fig. 5 shows the tapping side of a large stationary hearth furnace with a tilting bull ladle suspended from an electric hoist and light crane. In the operation, the ladle is lowered into the pit, sufficient metal is tapped out, and the ladle is then raised by the hoist, transferred to the mold line by the crane, and the metal poured.

Equipment for the transfer of metal from the furnace

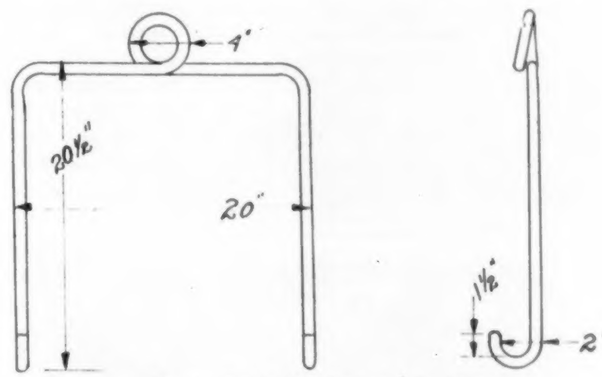


Fig. 4—Hook for Suspending Shank.

to the mold line-up, including chain hoists, electric hoists, mono-rails, and light cranes, is fairly standard and is supplied by manufacturers.

Ladle heaters, used in pre-heating crucibles and pouring ladles, may be purchased or made in the secondary plant. Extra handling of ladles may be avoided if the ladle heater is placed near the furnace tap hole. The ladle may be placed in position under the tap hole and the flames from the heater directed downwards into the ladle until sufficiently heated, and then pouring may be started.

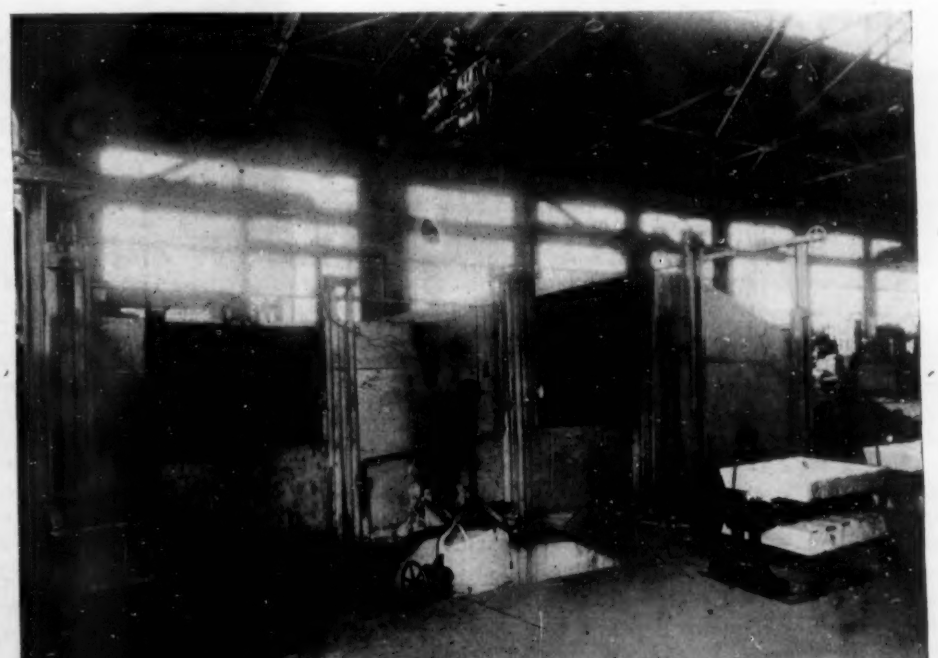


Fig. 5—Bull Ladle, Electric Hoist, and Overhead Crane for Transferring Molten Metal from Furnace to Molds.

Molds and Mold Racks

Secondary aluminum and aluminum alloys are cast into pigs of various weights but most producers prefer to pour large pigs weighing about 30 to 33 pounds. Pigs weighing 3 pounds and 30 pounds are the two sizes usually made but the bulk of the tonnage is in the heavier weight. Small pigs are often required by die-casting manufacturers and by some foundries. Secondary aluminum for deoxidizing steel is often poured into 1 pound 10-notch pigs.

Molds are usually made of grey cast iron. While both stock and special molds are sold by equipment makers, most secondary smelters design their own molds and have them cast by a local iron foundry. Pig molds are subjected to hard usage and constitute an item of considerable expense for maintenance and replacement. Molds should be designed with ample draft so that the pigs may be removed readily. The web of the pig should be sufficiently thick so that the pig will not break readily on handling when hot. The life of molds depends upon how hot they are run and the tonnage poured. Water-cooled molds are favored by some smelters. Such molds have longer life than ordinary molds since they can be kept cooler.

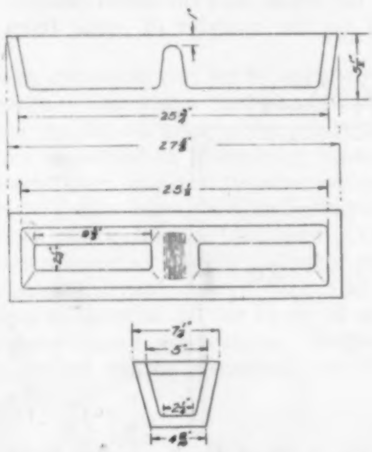


Fig. 6—Form of Mold for Pouring 30-Pound Pigs of Aluminum

Fig. 6 is a sketch showing the form and dimensions of a mold for producing 30-pound pigs of aluminum. Molds of this type are often mounted on an I-beam rack, provided with suitable mechanism so that the rack may be turned over and the frozen pigs dumped. A pig mold rack of this type may be seen at the left of Fig. 5. Five molds are bolted to each side of an I-beam, provided with bearings, mounted on suitable legs. In the process of pouring, the top set of molds is filled; then when the pigs are frozen, the rack is turned over so that the bottom set is in the pouring position. The pigs are knocked out of the inverted set of molds by bumping with a heavy hammer. A mold line-up of this type may be cooled with an air blast.

One method of water cooling pig molds is to place individual molds (such as shown in Fig. 6) in a shallow trough containing water. The molds may be bolted to a steel plate mounting, and the trough is made of light galvanized iron. Or, the molds may simply be set in a trough and not fastened. In the former case, the frozen pigs are removed by prying up one end and throwing them over. In the second case, the molds may be lifted out of the trough and dumped.

Some molds are cooled by water circulating in the interior of a bank of molds set back to back. Water cooled molds of this type should have heavy walls, and care must be taken to prevent leaks. If the walls are too thin, the iron may crack, water escape, and serious accidents occur. From six to ten mold cavities are provided in the design, two corresponding halves being placed back to back. Fig. 7 shows a design of water-cooled mold used for casting 1 pound 10-notch pigs. One or more blocks of molds may be mounted on a bench. In Fig. 7, two blocks of molds are mounted on three bench legs, the two molds being inverted at the same time.

Molds for making small pigs may be fastened to an endless inclined belt. The pigs may be poured by hand ladle, from a pouring ladle, or directly from the furnace. As the molds reach the high point of the belt, the pigs fall out or are knocked out.

The number of molds required in a plant depends, of course, on the tonnage to be run. A total of about 70 molds similar to those shown at the right of Fig. 5 is sufficient to handle a pour of around 20,000 pounds in a 10-hour day without undue overheating. Water-cooled molds such as those shown in Fig. 7, do not become overheated even with very rapid operation.

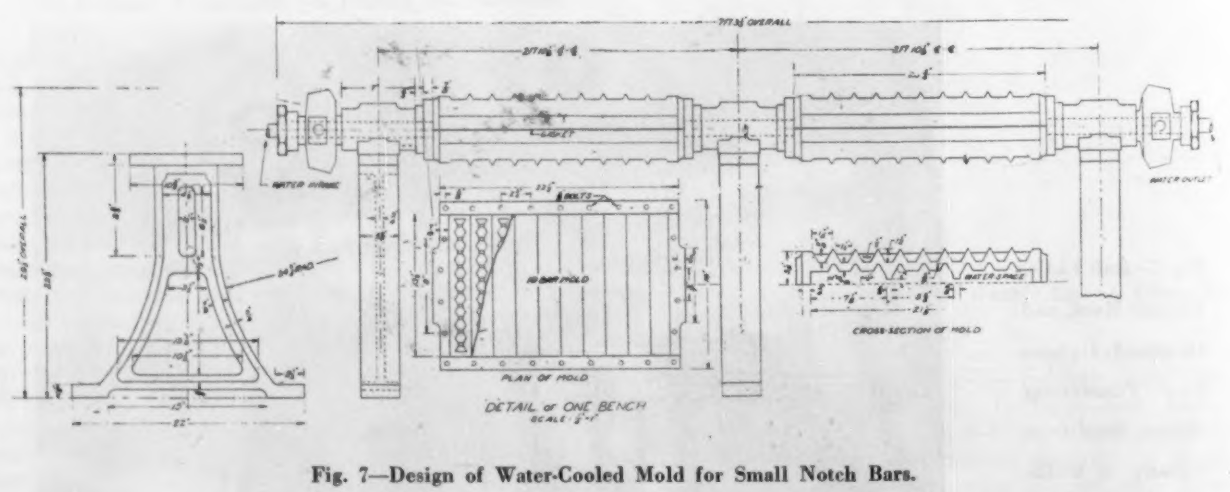


Fig. 7—Design of Water-Cooled Mold for Small Notch Bars.

This series will be continued in an early issue.—Ed.

The Casting of German Silver in Water-cooled Chill Moulds

By OTTO JUNKER

ADAPTED FROM AN ARTICLE IN "METALLWIRTSCHAFT"

THE process of casting slabs for the rolling of German silver plates involves greater difficulties than the casting of brass. For this reason the introduction of modern methods in foundries specializing in this class of metal presents considerable difficulties, as the experience of heavy works is that, after a change in their casting methods, the quality of metals produced tends to become slightly inferior to that of their previous output. Many works, therefore, still put up with the exceedingly wasteful methods of sawing up their ingots (30-35 per cent waste), in order to obtain really perfect, dense and homogeneous metal sheet slabs. Chill moulds unsupplied with cooling arrangement are, when used for nickel silver, subject to considerable wear, exceeding that which occurs when brass is cast on account of the much higher casting temperature. This necessitates extensive turning or milling of the cast plate slab in order to produce a clean surface.

The waste due to machining, to which also the runner waste must be added, amounts to not less than 15 per cent. In spite of such unfavorable results, due to current practice, the casting of German silver in water-cooled chill moulds has not been introduced as readily as has been the case with brass casting. The reason might have some connection with the less stringent demand for uniformity in casting German silver as compared with brass.

Conclusive results are now available in regard to the use of chill moulds of the Junker type, with copper walls and intensive water cooling. These have been obtained in the important nickel and German silver works of Messrs. Henry Wiggin & Co., Ltd., Birmingham, and extend over a number of years of continuous application. The results are so favorable that the advantages obtainable by using Junker type water-cooled chill moulds now appear to have been definitely established. The reorganization of Messrs. Wiggin's foundry was carried out most carefully. An experimental chill mould was tested over a period of two years; further the question of quality was definitely settled with the consumers who were operating with large quantities of sheet supplied to them; finally the complete reorganization of the foundry was carried out, and casting, based on the Junker type of chill mould, introduced.

Fig. 1 illustrates three water cooled moulds before dispatch. Messrs. Wiggin have maintained their old casting dimensions of approximately 170 mm. width, 550 mm. length, and 50 mm. thickness, giving a plate weighing approximately 37 kgs. These three moulds together with the previously supplied experimental mould, represent the complete mould equipment of their German silver foundry. Each mould serves four to five small shaft furnaces, so that casting takes place practically every 10 to 15 minutes per mould. With a working day of 24 hours the maximum cast output amounts approximately to 370 tons, and this output is easily maintained with the four small moulds.

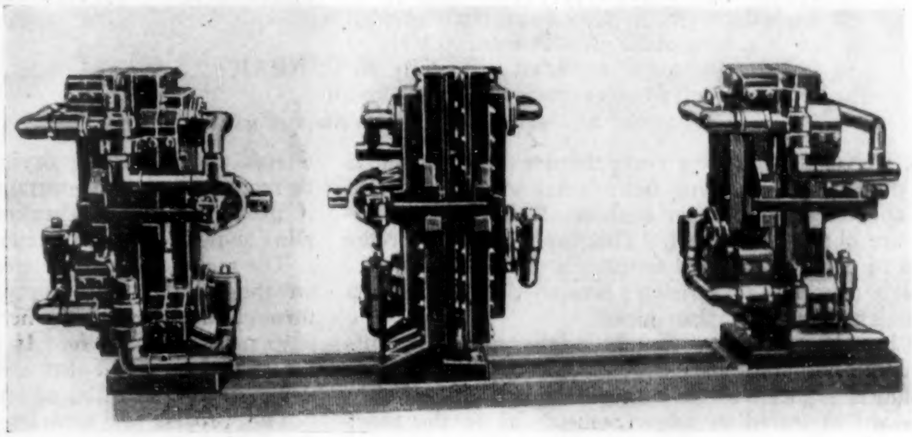


Fig. 1. Three Water-Cooled Moulds Before Dispatch

By means of correct gating the sprue is kept so small that it need not be cut off in the foundry. During the rolling operation the runner is removed simultaneously with the crop ends.

This serves to demonstrate the soundness of the plate, as, with the tendency of German silver to form pipe deeply, any appreciable piping would otherwise have resulted in the immediate splitting of the runner had it not been cut off. The cast plate is machined to a depth of 0.5 to 0.75 mm. by means of a horizontal milling machine.

The total waste in the foundry does not therefore exceed two to three per cent, due to milling. Even machining to a minimum depth with rigid millers tends to remove more material than the skin alone. By using a floating milling device, however, of the Junker type, the skin can be removed with less removal of the underlying metal and consequent waste. As the internal walls of the water-cooled moulds of the Junker type are not subject to wear and remain just as smooth after a thousand operations as after the first, and further, as absolutely uniform conditions of cooling can be obtained by regulating the supply of cooling water, the operator can be

made responsible for uniform and good results. The composition of commercial German silver alloys ranges from 7 to 20 per cent, or even to 25 per cent of nickel, with varying proportions of copper and zinc; the water-cooled mould can be used for practically all of these alloys.

Fig. 2—Samples of Deep Drawn German Silver

At the present time Messrs. Wiggin are casting all their German silver alloys in cooled chill moulds of the Junker type, and in particular those used for deep drawing and stamping purposes.

Stamped articles of German silver made from material cast by this process are completely free from any striation or unsoundness.

Fig. 2 illustrates two samples of deep drawing with a depth of 12.55 to 12.60 mm. and 1.25 mm. gauge. Both samples are made of an alloy containing 18 per cent nickel.

Messrs. Wiggin also cast with equally good results sheet slabs of pure supro-nickel alloys in chill moulds with intensive water cooling.

In conclusion, it can be said that these results, based on continuous working experience, definitely prove the economy of casting German silver sheet slabs in water cooled chill moulds.

Value of Chromium as a Finish for Plumbing Fixtures

By N. G. NEAR

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

DURING the past few years the use of chromium as a finish for plumbing fixtures has so increased that approximately 45 per cent of all fixtures now installed are chromium plated. This rapid growth for the demand of chromium plated fixtures is due to two things: first, high pressure advertising; second, the desire for a better finish if possible, than nickel.

The broad statements found in the advertisements have unquestionably led the public to believe that chromium is superior to other finishes. Up until recently not a word appeared in advertisements as to the short comings of chromium. The latest advertisement of a large licensing company states, "And now . . . the perfecting stage, during which the quality of chromium plate must be improved." Also, "Manufacturers and others now demanding chromium plate of greater dependability. People are 'chromiumwise' . . ." This advertisement was placed in a publication which reaches only manufacturers and not the purchasers of fixtures, plumbers or architects.

Chromium is listed as possessing corrosion resistant properties. How many have assumed that this statement is correct? Where either water or atmospheric conditions are bad, such a metal would be a boon. But thousands of complaints are received annually that the chromium is not standing up. Keen competition has exacted a guarantee on the part of the manufacturer regarding finishes. Why does not the chromium stand up?

First, the conditions as to the installations vary; the lavatory fixtures do not meet the same conditions as those in the vicinity of toilet bowls or urinals; second, the methods of care or cleaning vary; third, the processes of applying the chromium vary.

The lavatory fixtures seldom come into contact with urine. Either actual contact or vapors arising from the bowl or urinal readily attack the chromium. Chlorine and ammonia whose salts are present in urine penetrate the thin film of chromium. How many have noticed the green deposits on seat hinges and other fixtures? Upon cleaning these fixtures the base metal will be observed. The alternate wetting and drying of the fixtures appears to be more severe than constant immersion. Where chlorine is used for treating drinking water, the drinking fountains show the effect; likewise lavatory bibbs.

The method of care or cleaning has a pronounced effect on the durability of chromium. Abrasives soon wear through the thin film, whereas a damp rag with a little soap prolongs the life. If cleaning is neglected entirely the accumulation of dirt absorbs vapors which accelerate the destruction of film of chromium.

The process of applying the chromium is a factor. Some deposits are applied directly to the base metal. Again, the base metal is given a coat of copper, then nickel, with a final plate of chromium. If the base metal or alternate deposits are not chemically clean, the chromium will peel. The difference in contraction of the various deposits upon plating sets up strains which cause peeling. A heavy plate of chromium produces minute cracks, while a flash is very porous.

The Bureau of Standards specifies for the fixtures to be used in government buildings, a nickel thickness of .0002 inch and .00002 inch of chromium. These values are apparently arbitrarily specified since they have not made public the results of any tests.

Chromium in the automotive industry is still striving to replace other finishes. A purchaser of an automobile is well aware that the finish of the radiator and lamps is dependent on care. The thickness of the chromium seldom exceeds .0000075 inch, a mere flash, and in time, blotches of the base metal or rust soon appear. Tablets, such as nameplates for various concerns on the outside of buildings which are subject to atmospheric exposures, soon show a striated or crackled effect.

The causes for the failure of chromium plate have been a mystery to many plumbers as well as engineers of large buildings. These along with the public in general must be advised or educated to the shortcomings of the chromium finish.

Too much stress cannot be placed on the care of fixtures after installation.

The Electrodeposition of Silver-Cadmium Alloys

A Study of the Quantitative Data on the Factors Controlling the Percentage Composition of Electrolytically Deposited Silver-Cadmium Alloys

By Dr. COLIN G. FINK and BASIL G. GERAPOSTOLOU
Head, Division of Electrochemistry, and Chemical Engineer, Respectively,
Columbia University, New York City

A PAPER PRESENTED AT THE 18TH ANNUAL CONVENTION OF THE AMERICAN ELECTROPLATERS' SOCIETY, AT WASHINGTON, D. C., JULY 2, 1930.

HISTORICAL

A PROCESS for the electrodeposition of silver-cadmium alloys was first commercially developed and used by S. O. Cowper-Coles in England in 1890. An English patent was obtained by him on the process in 1892.[1] In this patent claims are made for the electrodeposition of silver-cadmium, silver-zinc, and silver-cadmium-zinc alloys from cyanide solutions. The composition of the silver-cadmium solution was:

Silver	½ oz./gal.
Cadmium	11½ oz./gal.
Free KCN	0.33-*M*.

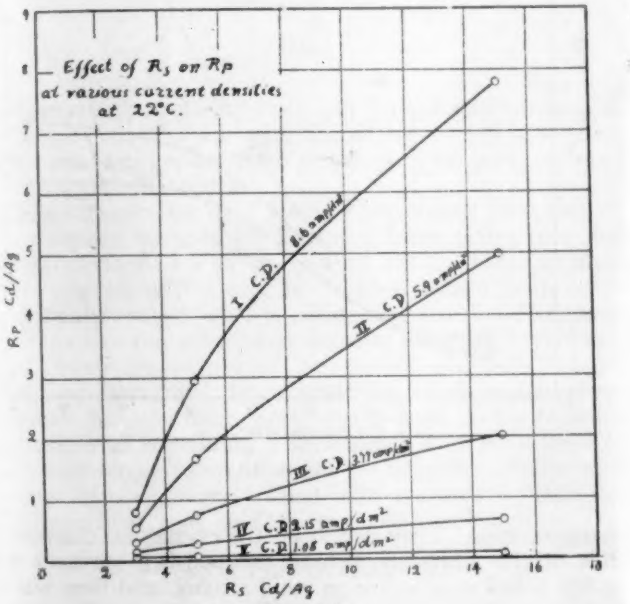


Figure 1

The patent claims cover the whole series of alloys from 5% to over 90% cadmium (or zinc). It is stated that silver-cadmium alloys similar in composition to the plate desired were used as anodes. Anodes containing 15% and 25% cadmium, respectively, are mentioned. The current densities and temperatures employed are not stated.

Philip[2] describes the same process and adds that a temperature of about 50° C. was employed, and that the alloys obtained were brittle. He does not give the current densities required for the various alloys.

In recent years considerable work has been done on the electrodeposition of certain alloys, especially brass, bronze, lead-tin, etc., and a number of the factors affecting the composition and character of the deposits have been studied.

Morgan[3] discusses the electrodeposition of brass (Cu-Zn) from cyanide solutions, and states that complex ions of the metals must be present in the solution, and that for good deposits the copper ion concentration of the solution must be kept low.

Spietzer[4], Field[5], Bennett and Davison[6], Honig[7], and Ferguson and Sturdevant[8] made studies of the electrodeposition of brass from cyanide solutions, and agree that:

(a) The simultaneous deposition of copper and zinc from cyanide solutions is due to the tendency of the potentials of the two metals to become equal.

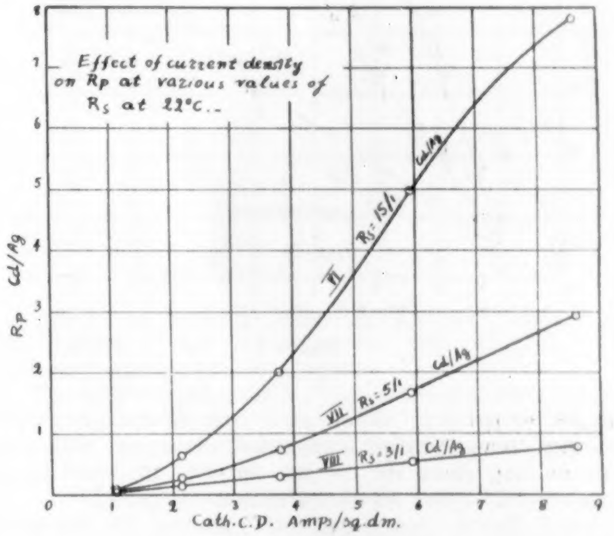


Figure 2

(b) An increase of the Cu-Zn ratio in the electrolyte results in the deposition of alloys richer in copper.

(c) An increase in temperature decreases the cathode polarization of copper and therefore increases the copper content of the deposit.

Mathers and Sowder[9] investigated the deposition of bronze (CuSn) from cyanide and oxalate solutions and found that the cyanide solutions gave the best results. They also found that an increase of the free cyanide content of the solution decreased the cathode efficiency.

Kremann, Suchy, and Maas[10], in connection with their

[1] British Patent No. 1,391 (1892).
[2] Philip, Revision of Watt's Electrochemistry (1911).

[3] Morgan, J. Am. Chem. Soc. *22*, 93 (1900).
[4] Spietzer, Z. Elektrochem. *11*, 172 (1905).
[5] Field, Trans. Farad. Soc. *9*, 172 (1905).
[6] Bennett and Davison, Trans. Am. Electrochem. Soc. *25*, 247 (1914).
[7] Honig, Z. Elektrochem. *22*, 286 (1916)
[8] Ferguson & Sturdevant, Trans. Am. Electrochem. Soc. *38*, 167 (1920).
[9] Mathers & Sowder, Trans. Am. Electrochem. Soc. *37*, 525 (1920).
[10] Kremann, etc., Monatsch, *34*, 1757 (1913); *35*, 731 (1914).

studies on the electrodeposition of nickel-iron alloys from sulfate-oxalate solutions, state that:

(a) Increase of the Ni/Fe ratio in the solution increases the Ni/Fe ratio in the deposit.

(b) Increase of the oxalate concentration in the bath increases the Ni/Fe ratio in the plate..

(c) Increase in temperature increases the Ni/Fe ratio in the deposit.

Glasstone[11] verified the work of Kremann. He states that an increase in the current density decreases the Ni/Fe ratio in the deposit. He also studied[12] the electrodeposition of zinc-cobalt alloys from sulfate solutions and found that a decrease in temperature decreases the Co/Zn ratio in the deposit.

Hineline and Cooley[13] deposited copper-nickel alloys from cyanide solutions with Cu/Ni ratios of 1:9 and 2:8 in the electrolyte. They state that with high current densities they obtained high-nickel alloys, but they mention nothing about the current densities employed or the composition of the deposits obtained.

Stout, Burch, and Langsdorf[14] studied the deposition of copper-nickel alloys and found that:

(a) The ratio of Cu/Ni in the deposit is always greater than that in the solution, and increases with increase of the copper content of the solution.

(b) The ratio of copper to nickel in the deposit increases linearly with temperature.

(c) At low current densities the deposits obtained are rich in copper.

(d) Increase of the free cyanide content of the solution decreases the rate of deposition of the alloy.

Efremov[15] plated copper-cadmium alloys from a cyanide solution with a Cu/Cd ratio of 1:1 in the solution. He states that he obtained an alloy of 67-72% cadmium, and that the free cyanide content must be below 0.3-*M*. He claims that temperature has little effect on the composition of the deposit.

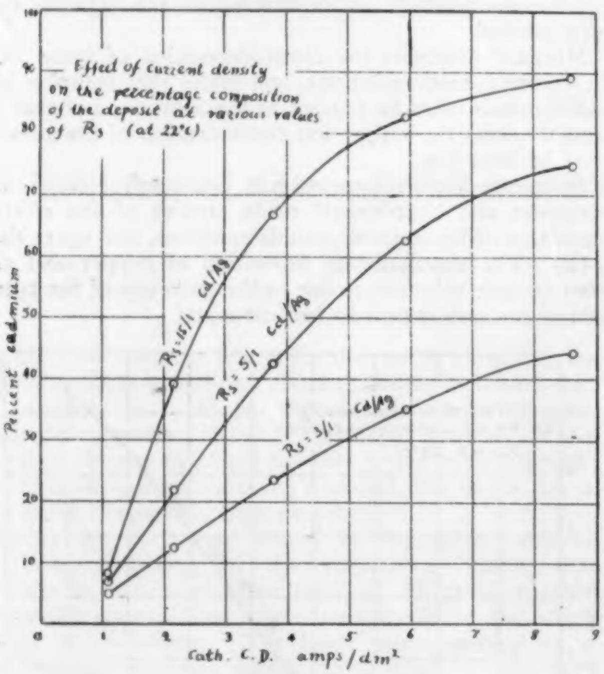


Figure 3

Blum and Haring[16] plated lead-tin alloys from fluoborate solutions and state that:

(a) Lead and tin have nearly equal potentials in fluoborate solutions.

(b) The composition of the deposit depends on the metal ratio in the bath.

(c) Increase in current density increases the tin content of the deposit in the case of solutions low in tin.

(d) The composition of the deposits is not affected by the composition of the anode provided that the composition of the bath remains constant.

Guillet and Cournot[17] obtained alloys of silver and cadmium (and also silver and zinc) by melting the metals together. The crystalline structures of the two alloys, containing respectively 49.25% and 59.96% silver, were examined after heating to (or cooling from) various temperatures. They developed the crystalline characteristics of the alloys by etching the polished surfaces with a 5% solution of iodine in ethyl alcohol, and then washed off the iodine with hot thiosulfate solution. Photomicrographs of various samples are given. In most cases a heterogeneous structure of the samples may be seen, consisting in each case of two constituents. They do not give a detailed description of the deposited silver-cadmium alloys, but they state that they hope to do so in the near future.

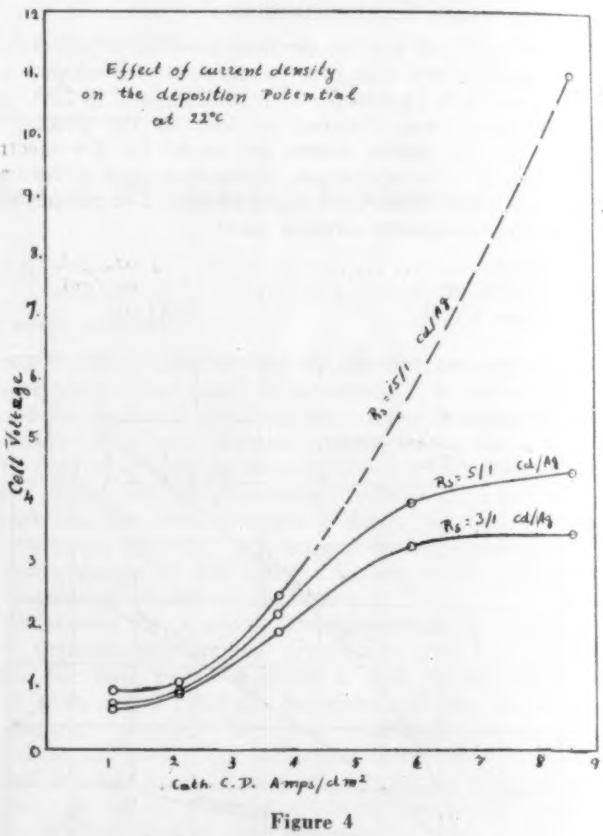


Figure 4

EXPERIMENTAL

In the plating solutions the complex cyanides of silver and cadmium were used. The chemicals were of the highest purity available. In the preparation of silver cyanide we used C. P. silver nitrate, and for the preparation of cadmium cyanide we used C. P. electrolytic cadmium rods. The sodium cyanide used in all this work was found by analysis to contain 99.9% NaCN and traces

[11] Glasstone, Trans. Farad. Soc. *19*, 574 (1924); *24*, 370 (1928).
[12] Glasstone, J. Chem. Soc. *130*, 641 (1927).
[13] Hineline & Cooley, Trans. Am. Electrochem. Soc. *48*, 61 (1925).
[14] Stout, Burch, Langsdorf, Trans. Am. Electrochem. Soc. *57*, 173 (1930).
[15] Efremov, Ann. Inst. Polytechn. Oural, *6*, 11 (1927).
[16] Blum & Haring, Trans. Am. Electrochem. Soc. *40*, 287 (1921).
[17] Guillet & Cournot, Re. de Metallurgie, 27, No. *1*, 1 (1930).

of chloride, ferrocyanide, and sulfate. The silver nitrate and the cadmium sulfate (made from cadmium) were separately treated with the required amounts of cyanide. After filtration and washing, the precipitated metal cyanides were separately dissolved in sodium cyanide. The two solutions were analyzed and served as stock solutions for the preparation of the plating baths.

The following three solutions we prepared for the experimental work:

Soln.	Cd-Metal Conc. Molar	Cd-Metal Conc. g/L	Cd-Metal Conc. oz./gal.	Ag-Metal Conc. Molar	Ag-Metal Conc. g/L	Ag-Metal Conc. oz./gal.	Free NaCN Conc. Molar	Free NaCN Conc. g/L	Free NaCN Conc. oz./gal.	Rs Cd/Ag Molar
A...	0.75	84.3	11.25	0.05	5.4	0.72	0.35	17.15	2.29	15/1
B...	0.75	84.3	11.25	0.15	16.2	2.16	0.35	17.15	2.29	5/1
C...	0.75	84.3	11.25	0.25	27.0	3.60	0.35	17.15	2.29	3/1

The silver anodes were prepared from pure electrolytic

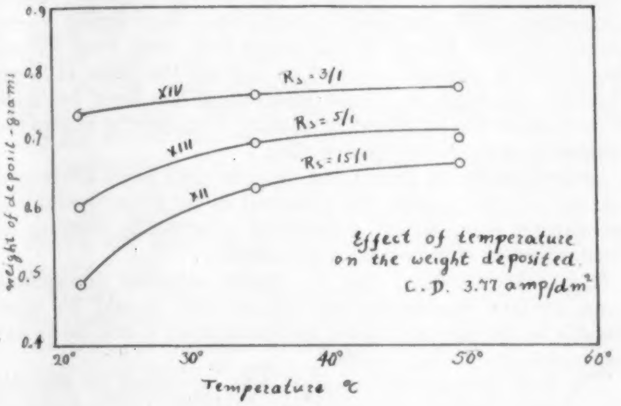


Figure 5

silver crystals cast into rods and forged into plates 3/32 inch (2.3 mm.) thick with the aid of a hydraulic press. The cadmium anodes were prepared from pure cadmium rods forged into plates.

The cathodes we used were of two kinds. For analytical purposes we used 60/40 spring brass plates each with a total surface of 1 sq. in. (6.5 sq. cm.). These cathodes were cleaned with a wire brush, then with a cloth brush, and finally wiped with a clean, dry towel. This treatment caused the subsequent deposits to be not very adherent (when the weight of the deposit was over 0.4 g.). The deposits could be stripped by bending the plates. Similar cathodes that were also pickled in concentrated sulfuric acid containing a little nitric acid were used for the microscopic examination of the deposits. Rolled sheet copper cathodes were treated with a mercury "blue dip" for corrosion tests and microscopic examinations.

ANALYSIS OF SAMPLES

The weights of the deposits were determined by weighing the cathodes before and after plating. Considerable difficulty was experienced in the beginning in finding a quick method of analysis that was accurate enough for our purposes. We first tried chemical stripping of the deposits with a mixture of concentrated sulfuric and nitric acid. This method worked well with the deposits low in cadmium, and introduced very little copper from the plate into the solution. But, as the cadmium content of the deposits became higher, there was a residue in the form of globules which could not be dissolved even after considerable amounts of the copper dissolved from the plate. This undissolved deposit was found to contain a considerable amount of silver. Finally the treatment of the cathodes described in the preceding paragraph was adopted. The deposit was removed by bending the cathodes, and a certain amount was weighed for analysis.

Analysis: about 0.25 g. of deposit was dissolved in concentrated nitric acid, evaporated to dryness, the residue dissolved in water, and the silver precipitated as chloride with 0.5-*N* HCl. After heating to coagulate the precipitate, and cooling, the latter was filtered out, washed, and dissolved in a measured volume of standard sodium cyanide solution. The excess of cyanide was titrated with 0.1-*N* silver nitrate.

The filtrate was evaporated to dryness to expel all the acid, the residue was dissolved in water, and after adjusting the acidity, the cadmium was precipitated as sulfide. The sulfide was dissolved in 1:3 HCl, evaporated to dryness with sulfuric acid, and weighed as cadmium sulfate.

This analytical procedure yielded results within one per cent for amounts of silver from 0.1 to 0.3 g. The weights

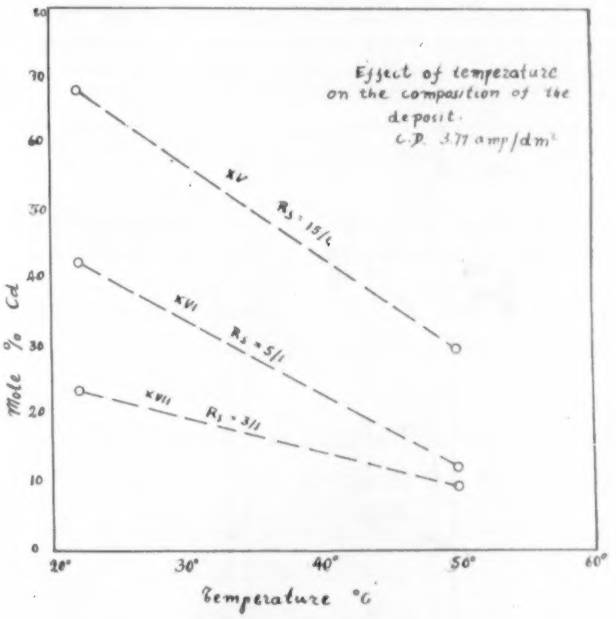


Figure 6

of silver and cadmium found by analysis checked with the weight of the deposit within one per cent. This accuracy was considered adequate.

The microscopic examination of the deposits was carried out with the assistance of Dr. Eugen P. Polushkin who also prepared photomicrographs of etched samples.

EXPERIMENTAL PROCEDURE AND RESULTS

In the electrodeposition of the alloys, the current densities were from 10 to 80 amp./sq. ft. (1.08 to 8.6 amp./sq. dm.).

The baths had a volume of 150 cc. each. In order to maintain the compositions of the baths approximately constant, we used separate silver and cadmium anodes, two silver and one cadmium for the lower current densities, and two cadmium and one silver for the higher current densities.

In each set of experiments three cells containing, respectively, solutions A, B, and C were operated in series. The time of deposition for each current density was adjusted so that the same number of ampere-hours passed in each experiment.

Mild mechanical agitation was employed in order to keep the solutions homogeneous throughout the plating period.

The experimental results are shown in Tables I and II, and plotted in Figs. 1 to 6.

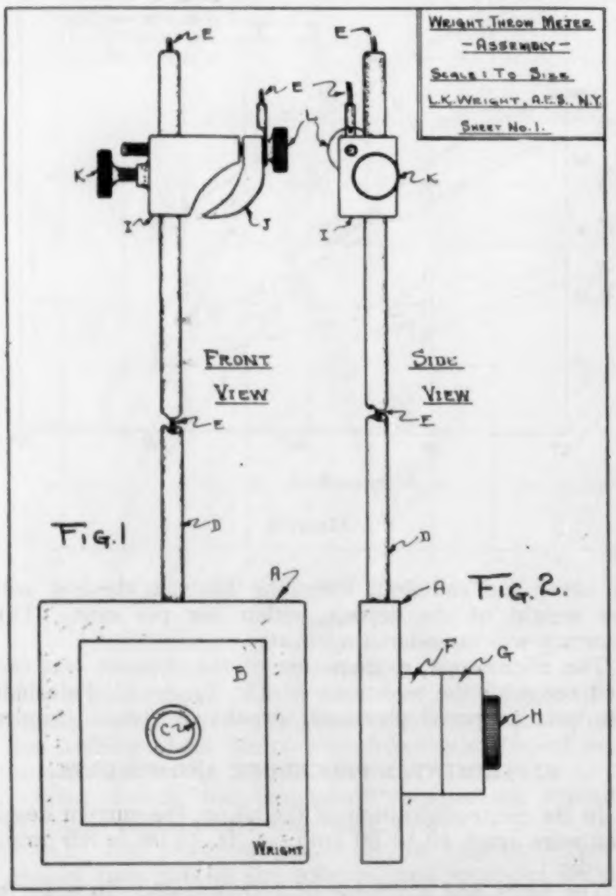
This article will be concluded in an early issue.—Ed.

A Comparative Measurement of Throwing Power in Electroplating Practice

By L. K. WRIGHT
Metallurgist

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

THE average commercial electroplater is not greatly concerned with the comparative current efficiency of various electrolytes, since his interest lies mainly in the color, appearance and covering power of the plates produced. Some electroplating baths, which may possess high current efficiency, are not suitable to general commercial adoption because the coatings resulting from the use of such electrolytes do not "throw" well, leaving the hollows and depressions of a cathode unplated, or if greater electrical force be applied in an attempt to overcome this fault the projecting portions may be "burned" before the bottom of the depressions are coated. To the plater such a procedure means additional handling and, of course, increased labor costs.



Therefore the practical plater deems it best to operate an electrolyte possessing good throwing qualities rather than utilize a solution economical of electric current but wasteful of labor, since the latter factor represents the greater portion of the cost of production.

Within recent years the electroplater has emerged from amid his mystic pots and bubbling secret formulae and joined with his fellow artificers in what years ago would have been termed a guild, or company, formed with the sole object of assisting in the dissemination of knowledge to one another for the furtherance of their trade and betterment of products. This, coupled with keen competition, price factors, and improved methods has resulted in considerable advancement in electroplating processes, formulae, technique and products.

The factory executive or superintendent is concerned with all pertinent details of manufacturing and is interested in the production of better goods at lower costs. Executives and energetic platers are considering every single expense factor which enters into total cost. Even the electrical energy required to deposit the plate is being checked, although no simple instrument has been available for common use in all electroplating formulae to obtain the comparative throwing power data.

Several methods have from time to time been advocated but usually the results are obtained in an experimental or laboratory way, which sometimes represents nothing of great value in commercial applications.

It is acknowledged that for really accurate determinations, certain intricately formed articles should be tried directly in the plating tanks, for sometimes it will be found impossible to predict results.

The first comparative method was advanced by Horsch and Fuwa,[1] which consisted in obtaining the amount of metal deposited upon each of three connected cathodes, stationed in certain juxtaposition to each other. This method entailed the use of an analytical scale, required laboratory exactness and while the results were comparative no idea was obtained as to the value of the formulae tested in its power of entering depressions, for the test was conducted with flat strips.

Haring and Blum[2] advocated what is known as the Haring Cell for obtaining the throwing power on flat plates. Haring[3] made further tests concerning the throwing power, cathode potentials ad efficiencies of nickel solutions in his cell. Later[4] he conducted further tests. The Haring Cell provides interesting data but such comparative determinations entail too much laboratory work to be of assistance to the plating room.

Another method, especially adapted for chromium determinations, proposed by Sizelove and also Pinner and Baker[5] consisted of using a bent copper strip as a cathode, the extent of the chromium deposit in the bend being taken as a gauge or basis of comparative throwing power.

A short time ago, Pan[6] described a cavity scale for throwing power determinations, which consisted of a bar of metal drilled with a number of holes of varying depth, used as the cathode and for determining the throwing power by observation as to which depth represented the maximum throw. This method was simple and involved no weighing or lengthy computations, but it had the one drawback in that the plater was obliged to very accurately

[1] Trans. Am. Electrochem. Soc., Vol. XLI, 363, 1922. "A Study of the Throwing Power and Current Efficiency of Zinc Plating Solution," W. Grenville Horsch and Tyler Fuwa.

[2] Trans. Am. Electrochem. Soc., Vol. XLIV, 313, 1923, and Monthly Review, Am. Electroplaters' Soc., Aug. 1923; "Current Distribution and Throwing Power in Electrodeposition," H. E. Haring and W. Blum.

[3] Trans. Am. Electrochem. Soc., Vol. XLI, 107, 1924. "Throwing Power, Cathode Potentials, and Efficiencies in Nickel Deposition," and U. S. Bur. of Standards Letter Circular 125 (1924), H. E. Haring.

[4] Am. Electrochem. Soc., Vol. XLIX, 1926 and Am. Electroplaters' Soc., April, 1926; "A Simple Method for Measuring Polarization and Resistivity," H. E. Haring.

[5] Trans. Am. Electrochem. Soc., Vol. LV, 315, 1929. "The Bent Cathode Test for Determining the Optimum Ratio of Chromic Acid to Sulfate in Chromium Plating Baths," W. L. Pinner and E. M. Baker.

[6] The Metal Industry, June, 1930, page 271. "The Cavity Scale for Measuring Throwing Power," L. C. Pan.

drill the test bars. The drilling of the special bar occupied too much time, despite the fact that in the end it offered a fool proof method of determining the throwing power. Another disadvantage, affecting its simplicity, was that the conductor rod was not insulated and the amount of cathode surface varied with the depth the determination was run at.

The method advocated by the writer is one which utilizes a carefully made instrument, in which tubes are quickly inserted and tested. The test tubes are easily made up and may be stocked for use. The apparatus may be purchased, as well as a supply of tubes so that the work of making determinations is reduced to the very minimum. Or, if desired, the specifications may be secured and used in constructing the instrument.[7]

Since iron and brass constitute the preponderance of goods being plated, the instrument has been designed to receive stock test tubes of these metals. If copper, tin, zinc, lead or cadmium must be covered, the test tubes may be given a thin flash of the desired metal, before obtaining the throw data of the covering plate.

As shown in Fig. 1 the instrument consists of a rubber plate, (A), wherein is fixed the current distribution plate, (B), the center of which is pierced and threaded to receive a test nipple or tube, (C), same being inserted from the rear.

Figure 2 depicts a side view of the instrument and after the insertion of a test tube within the blocks A-F-G, a rubber plug (H) is used to seal the entrance. If desired this plug (H) may be left out and two readings taken, one for a test where the evolved hydrogen is free to escape from both ends of the tube and the other with the plug in place allowing the gas only one exit, which of course presents greater polarization.

An insulated hollow tube (D) wherein a stranded conductor (E) is run, connecting the plate (B) with the cathode rod clamp (J), is used to suspend the test plate in the electrolyte. The surface of the plate (B) is fixed and does not vary with any depth. The instrument may be submerged to any and all usual depths without change in the amount of cathode surface offered, thus eliminating bothersome calculations.

The clamp (I), which is slidably mounted on the suspension tube (D), so that the device may be submerged to the desired depth, is provided with a knurled set screw (K) to lock the clamp at the required point. An adjustable jaw (J) on the clamp provides means of affixing to almost any size of conductor or plating rod met with in either the laboratory or on commercial plating tanks, for it will clamp rods from 1/4" to 1 1/2" in diameter.

The instrument is capable of fine adjustment for it can be hung squarely in the bath at any depth facing the anodes. The sliding clamp allows the plate to be turned to any angle from that of directly facing the anodes to a 180° difference.

To perform a test the instrument is prepared by inserting a new test tube, washing and cleansing in the usual manner and then setting up to the required distance from the anode in the plating tank, at whatever depth the test is desired to be run at. The plating current and density is set to the desired point at which the throw is to be determined, and the instrument left for a period dependent upon the electrolyte, which may vary from 2 to 20 minutes.

At the end of the plating period the instrument is removed, washed and the test tube extracted. The instrument itself may be placed in a small vessel containing a solution of sodium cyanide and caustic soda (about 50 grams each/liter) and made to act as an anode. This will effectively remove copper, brass, zinc, tin, silver and cadmium platings, which form a goodly portion of plated goods. Another solution, consisting of 1 gal. 66° sulphuric acid, 1 pint of water and 1 oz. of glycerine, may be used as a stripping solution for nickel, copper, brass and silver. The instrument acts as the anode and cathodes of carbon or lead may be used. Use a 6 volt current. For chromium stripping a lye solution may be used.

If desired the plate surface may be polished with a sheet of fine emery, and then the instrument may be dried and placed away until required again. Where comparisons are made in baths of a similar sort a series of tests may be run with the instrument before any appreciable film of metal is deposited and requires removal.

The exposed test tube is dried and then the Throw Scale, shown in Fig. 3, is inserted so that the projecting stop or pin is held tightly against what had been the open end of the tube. Visual observation is made to ascertain the depth of the throw, measured by the Throw Scale,

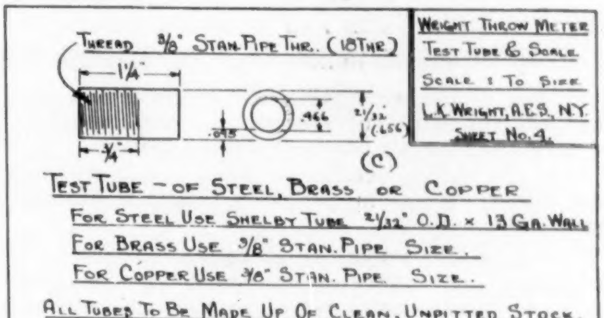


FIG. 4.

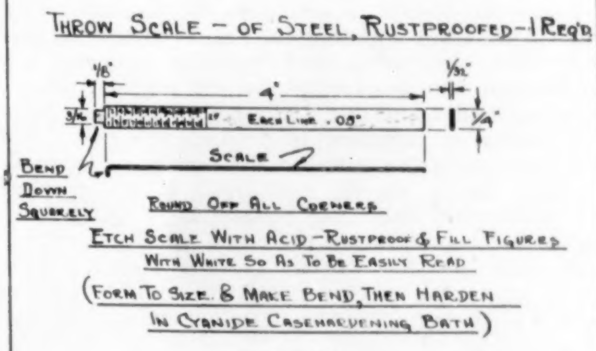


FIG. 3.

which is calibrated with lines etched every .05" apart and numbered from 1 to 25.

Means are thus available to test a solution for the best operating current and when the determination is established it may be compared with another electrolyte.

The distributor plate (B) measures 2.28" x 2.28" and has 5.198 sq. in. of surface. The hole drilled through the plate, of .578" in size, reduce the plate surface to 4.936 sq. in.

The tubes (shown in Fig. 4) used for test purposes, measure .656" O. D. x 1.25" long, with a wall thickness of .095", thus having .466" I.D. The end of such a tube presents .1674 sq. in. and the internal surface 1.809 sq. in. This tube is the standard 3/8" iron pipe size.

The total cathode surface, that is tube and plate, is 7.0 sq. in. and the plating is deposited with a current calculated on this basis.

After using a tube it may be strung upon a soft iron wire and immersed in a stripping bath, and when clean may be carefully dried, wrapped and preserved until again required.

It will thus be apparent that the instrument requires but little calculation in its use, is simple, fool proof and capable of presenting accurate data of value alike to both commercial and experimental platers.

[7] From L. K. Wright, c/o A. S. M. E.—29 West 39th St., New York.

Recent Electroplating Literature

Abstracts of Papers Published on Various Phases of Electroplating in the United States and England

By DR. A. K. GRAHAM
Associate Editor

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

STUDIES IN THE ELECTRODEPOSITION OF METALS

By Donald B. Keyes and Sherlock Swann, Jr.

University of Illinois Bulletin No. 206, May 20, 1930.

Because of the widespread use of chromium plated materials the value of research in electrodeposition of uncommon metals has been demonstrated. On this account the author decided to study aluminum, beryllium, boron, chromium, tungsten, titanium, vanadium, and cerium.

Theory of Electroplating Uncommon Metals. The commercial methods now employed for the electroplating of metals make use of an aqueous solution of salts as the electrolyte.

Water, however, may not be used as a solvent in the electrodeposition of many metals for several reasons. Aluminum and magnesium, for example, have never been electrodeposited from an aqueous solution because the positively charged hydrogen ion of the water will come out as gaseous hydrogen before the potential is sufficient to produce the metal from the metal ion, or the metal at the instant of formation (probably in an atomic condition) reacts promptly with the water, liberating molecular or gaseous hydrogen, and transforming the metal back to a positive metal ion. In other words, strongly electro-positive metals cannot be electrodeposited from an aqueous solution of their salts, at least at low current densities and with high efficiency. If, therefore, an electrolyte that had no easily replaceable hydrogen ions were used the liberation of these highly electropositive metals might be expected.

Such an electrolyte should first of all be a conducting liquid at room temperature, or a little above. This debars the common fused salt mixtures which have formed excellent electrolytes for certain purposes, as, for example, the fused mixture of fluorides used in the electrolytic reduction of aluminum oxide to produce metallic aluminum. The temperature used in this case, around 1,000 deg. F., is far too high for the making of a satisfactory electroplate. This practically limits the consideration to organic liquids. The electrolyte may, however, be one of at least three different types—a metal salt dissolved in an organic liquid, an organic metal complex in the liquid form, or an organic metal complex dissolved in an organic liquid. It should be remembered that most organic liquids are non-polar in nature and therefore non-conducting. The few types that are polar and conducting are usually the lower alcohols, aldehydes, and some unsaturated compounds. Fortunately, however, the introduction of a metal group to form a metal organic complex may increase the conductivity or polar character to a marked extent. This is especially true if nitrogen is one of the elements of the complex; this condition is brought about by the peculiar nature of the nitrogen atom.

The problem then becomes largely one of synthesizing various metal organic complexes **in a very pure condition.** From structural considerations these should be good conductors of electricity, and at the same time be in a liquid condition at room temperature or a little above.

Besides the highly electro-positive metals there are others that have never been electrodeposited at room temperatures. Such electrolytes as described in the foregoing paragraphs should be of use in this problem.

Some metals, as, for example, chromium, are now being plated out from an aqueous solution of their salts, but only from a high valence condition. It is necessary to have chromium ions with a valence of six instead of three in order to obtain a satisfactory plate, which means that a greater amount of power must be used to produce a certain thickness of plate than would be necessary if this condition were not required. It is reasonable to believe that a radical change in the electrolyte might remedy this condition.

Then, too, the "throwing power" of water electrolytes is often poor. By "throwing power" is meant the ability of the current to deposit metal from the electrolyte into crevices in the article being plated. It is possible a change in electrolyte would change this condition.

It was, therefore, hoped to electroplate metals either from solutions of their salts in organic solvents, or from liquid complex compounds which had been successfully used in electroplating aluminum.

Results and Conclusions. Since the continuous electrodeposition of the metals mentioned in this bulletin from aqueous solution or solvents of high dielectric constant failed in every case, it is believed that the successful deposition of amphoteric metals must take place from highly ionized complex compounds.

In the cases where plating from aqueous solution was attempted it was found that the solutions would conduct current, and therefore the metals appeared to behave like the strongly electropositive metals. In the non-aqueous solutions the salts were not ionized and no current would pass. The only exception was chromic chloride in formamide which has a higher dielectric constant than water. In this case the reasons for obtaining no chromium plate might be either the behavior of chromium as a strongly electropositive metal, or the formation of an organic chromium compound with the solvent.

Aluminum was found to be the only metal which could be electrodeposited from the complex formed

with tetraethyl ammonium bromide and its halide. It was found necessary to use the bromide for successful deposition of aluminum as aluminum chloride or fluoride caused the decomposition of the quaternary complex.

The failure of the other metals to plate under these conditions may be due to several causes. In the case of boron it is very probable that the tetraethyl ammonium bromide was still wet even after recrystallization, and that boric acid formed as soon as the boron tri-bromide was mixed with it, as the boron halides are extremely easily hydrolyzed. It does not seem probable that a high melting complex would result from the addition of such a low melting compound as boron tri-bromide, which is a liquid, to tetraethyl ammonium bromide when aluminum bromide, M.P. 90 deg. C., forms a complex melting at room temperature.

In the case of titanium it would appear that the complex did not form readily, otherwise conductivity would be expected.

Cerium, vanadium, chromium and tungsten halides form complexes only above the decomposition point of tetraethyl ammonium bromide on account of their high melting points.

It is doubtful whether another halide would be more stable than tetraethyl ammonium bromide, as all these substances decompose at fairly low temperatures.

The most probable method for plating these metals appears to be from an organometallic compound in ether, and it is the intention to continue the investigation along this line.

Appendix—Method of Electroplating Small Objects with Aluminum

Small objects may be electroplated with aluminum by the use of aluminum Grignard compounds in an ether solution. The complete procedure for making these compounds and carrying out the electrolysis is as follows:

To 7 g. of aluminum powder in a large test tube are added 12 g. of redistilled ethyl iodide. A two hole rubber stopper is fitted into the tube, one hole for a reflux condenser, and the other for a glass tube for the purpose of passing dry nitrogen into the reaction chamber.

At the top of the reflux condenser is fitted a two hole rubber stopper, one hole for a separatory funnel containing 38 g. of ethyl iodide and the other hole as an outlet for gases.

Dry nitrogen is allowed to flow through the tube containing the aluminum and ethyl iodide for about fifteen minutes until all the air is displaced. An oil bath is put under the test tube, which is heated to about 100 deg. C. until the reaction starts. When the reaction between the ethyl iodide and aluminum begins the oil bath is removed, and ethyl iodide is allowed to drop in from the separatory funnel until there is no more action. The oil bath is then put under the tube and it is heated for an hour at 125 deg. C. The mixture, containing diethyl aluminum iodide and ethyl aluminum di-iodide, with some free aluminum, is then cooled in an ice bath, and about 50cc. of absolute ether added through the reflux condenser, a little at a time, on account of the large amount of heat liberated during the formation of the Grignard etherates. After all the ether has been added, and a homogeneous solution has been obtained, the mixture is ready for electrolysis.

A rubber stopper which fits the reaction test tube is fitted with an aluminum anode (stick) and a copper cathode, and a hole for liberation of nitrogen. As the throwing power of the solution is not very good, it is advisable to have the anode the same shape as the cathode. Only one side of an object may be plated at one time.

The cathode should extend beneath the surface of the liquid so that a current density of 0.02 amp. per sq. cm. may be attained. Dry nitrogen is passed through the vessel during the entire electrolysis.

At the beginning of the electrolysis a large amount of gas will be given off, but as it proceeds this will die down. The solution will be dark in color and at this point the plating is most efficient. The electrolysis will take about three hours.

At the end the electrodes are quickly removed and the test tube stoppered. The cathode is washed with alcohol and rubbed clean with a cloth.

IMPROVEMENTS IN BLACK RUSTPROOF FINISHES

By C. H. Proctor

The Monthly Review—August, 1930

In presenting his paper under the above title at the recent convention in Washington, the author claims to have improved the black finish which he obtained upon zinc by immersing in a solution consisting of 2 to 4 ounces per gallon of sodium hydroxide and ¼ to ½ ounce per gallon of antimony oxide.

The improvement consists in immersing the zinc deposit obtained from any satisfactory cyanide solution after thoroughly rinsing free of cyanide, in a black nickel solution of the following composition:

4 oz. nickel chloride
6 oz. ammonium chloride
2 oz. sodium sulpho-cyanide
½ oz. zinc chloride
1 gal. water

The solution is heated to about 100 deg. F. and the article after immersion, if held in the air for a moment, will turn black very quickly. It can then be rinsed, dried and either oiled or lacquered.

The only constituents that are essential to control are nickel chloride and sodium sulpho-cyanide.

PROBLEMS IN CADMIUM PLATING

By Gustave Soderberg

The Monthly Review, August, 1930

In the above paper presented at the Washington convention, the author discusses four problems in connection with the use of cadmium plated goods. The first problem deals with the subject of contact resistance between metals, and the author states that the initial value of the resistance of the working contact of contactors and circuit breakers is often from 5 per cent to 20 per cent of the ohms resistance of the device. If oxidation sets in, the contact resistance may entirely overshadow the ohms resistance.

Tests showed that the contact resistance between copper surfaces increased four times at 20 lbs. per square inch pressure and 2½ times at 500 lbs. per square inch pressure when the contacts were cadmium plated. This increase disappears entirely on heating for one hour at 210 deg. C, which eliminates the firm resistance between the copper and the cadmium, probably by causing slight alloying.

The second topic is "Soldering to Cadmium Plate." Under this heading the author discusses the desirability of obtaining clean surfaces on copper or steel before plating with cadmium in order to have adher-

ence and also the importance of having a clean cadmium surface prior to soldering.

He further states that the solder should have a composition that easily alloys with the cadmium forming a solid solution on cooling, that the lead content of the solder should therefore be low and in some kinds the tin content relatively high, since this constituent is said to be the only electro-positive metal which does not accelerate the corrosion of cadmium.

The flux used in soldering serves a triple purpose. It should clean the surface dissolving oxides; it should exclude the air and prevent oxidation; it should make the solder flow freely by lowering the surface tension. While ordinary zinc chloride-ammonium chloride mixtures fulfill these requirements they corrode cadmium and should not be used. Several non-corrosive soldering fluids are available and resin core solders have proven the best of their type.

In soldering the cadmium plated surface it should finally be remembered that the melting point of cadmium is low (321 deg. C.) and that it starts to oxidize with appreciable rapidity at a temperature as low as 260 deg. C. A sufficient amount of flux must be used to exclude the air from the molten cadmium and the temperature and time of application of the soldering iron must be regulated so that the back side of the thin gage sheet material does not oxidize or melt.

Under the third topic of blackening and painting cadmium surfaces, it is stated that lacquering is the only fully satisfactory way to overcome tarnish, finger marks, and spotting-out.

A number of the more progressive lacquer manufacturers are said to be producing satisfactory products. Furthermore, when the shape of the article allows for proper draining the work may be taken directly from the hot rinse and immersed in a water dip lacquer. The work comes out without a stain.

It is only recently that pigment lacquers have proven at all successful and a limited number are available. Some soft and sticky paints adhere well to cadmium, but hard baking japans do not. Special purpose paints are said to be successfully used by the Navy with very good results.

The last topic discussed deals with the statement that cadmium coatings on brass will disintegrate on exposure to a tropical climate and that cadmium is unsuitable under such conditions. A chemical analysis of the non-adherent white powder which formed showed that it contained water soluble organic metal. This was shown to be the result of corrosion induced by the acid contained in the varnish paper used as an insulating material and it was shown that if the acid number of such papers were low enough, corrosion would not take place.

These abstracts will be continued in an early issue.—Ed.

Chromium on Spinnings

Q.—We are sending you a chromium solution sample for analysis.

We have trouble plating spun work 6 inches in diameter with center raised flange. Chromium deposits on about one inch in from edge. We have no trouble with small castings except when more than six pieces are placed in tank at once. Amperage drops then considerably. Tank is 36 x 29 x 29 inches. Solution is operated at 95° F. Generator is 6 volt, 500 ampere.

A.—Analysis of chromium solution:

Chromic acid	49.28 oz.
Trivalent chromium	1.32 oz.
Sulphates	.84 oz.
Iron	none

Both the sulphate and trivalent contents are too high. Would suggest that the sulphate content be reduced by adding to the 130 gallon solution 6 pounds of barium carbonate. Dissolve the barium carbonate in water before adding to solution and then add slowly and stir solution thoroughly. The trivalent content should be reduced by the porous pot method.

Oliver J. Sizelove.

Tank for Gold Plating

Q.—I am using a steel enameled tank in which the enamel is chipping off considerably. I use the tank for a gold cyanide solution. Will you please tell me what effect this condition might have on the solution? Will it precipitate the gold?

A.—It is not advisable to use an enameled iron tank for a gold solution after the enamel has broken away. While the amount of gold that would be thrown out of the solution would be negligible, the gold solution in time would contain enough iron to affect the color of the deposit.

We suggest that you use a stoneware tank for the gold solution. This should be placed in a larger iron or wooden tank to hold water which should be heated to regulate the temperature of the gold solution.

Oliver J. Sizelove.

Silver Solution

Q.—Our solution for silver plating gives trouble by plating rough and unevenly. We have a 200-gallon tank of it, sample of which we are sending you. Will you please analyze this sample and let us know the following:

Ingredients in the solution and amounts per gallon of each.

Impurities, if any.

Outline of proper procedure for plating with this solution if it can be corrected. We would rather repair it than make a new solution, of course.

A.—Analysis of silver solution:

Metallic silver	1.72 oz.
Free cyanide	12.39 oz.

The metal content is quite low and the free cyanide content is entirely too high. It will be necessary to reduce the free cyanide and also raise the metal content. This may be done by adding to the 200 gallons of solution 600 ounces of silver chloride. Add the silver chloride to the solution and stir until it is all dissolved. The solution will then contain 3.82 ounces of metallic silver and approximately 6 ounces of free cyanide to each gallon and should give good results if operated at a cathode current density of 4 to 5 amperes per square foot.

Oliver J. Sizelove.

THE METAL INDUSTRY

With Which Are Incorporated

The Aluminum World, Copper and Brass, The Brass Founder and Finisher, The Electro-Platers' Review

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Contents

THE METAL INDUSTRY is regularly indexed in the "Engineering Index" and the "Industrial Arts Index"

Edition this Month, 6,500 Copies. Buyers Guide, Advertising Page 77.

Editorial

How Is Business?

WE have learned from bitter experience that politics and politicians are poor prophets of business. We know now also that few if any nationally known business leaders will at any time publish pessimistic statements, regardless of the actual facts. After a year of disappointment, the public has decided that the value of optimistic statements in the press is little or nothing at all.

For that reason, in our leading article in this issue, we quote unsigned opinions. They are authoritative, being the statements of leading executives in their fields. They are direct because they are answers to specific questions. They are unvarnished because the writers have evidently had enough of false optimism.

Here is the important point, however. Not one of them is downhearted. Not one of them expects anything but a return to prosperity. All of them are hard at work holding their industries intact, and climbing back out of the slough.

But what of the future? Must we go through these recurrent booms and slumps forever? Is there no way out of the "business cycle"?

We commend to the attention of our readers, the suggestions emphasized in the symposium. Business should be supplied with brakes which can be applied to keep booms from going too far, thus preventing overspeculation—the worst possible aggravation. Our producing capacity is too great for normal consumption under present conditions and is kept fully employed only at peak periods.

Let us stop expanding. In dull times, the Government and the largest utility and industrial corporations can concentrate their expenditures for replacement and new developments to fill in the gap left by the recession of other industries.

There is no sure cure and there is no one who knows how to set the business world aright. We are still groping. But by all means, in our future efforts, let us remember the lessons of 1921, 1930 and former depressions. When business returns, which it will, of course, and much sooner than calamity howlers expect, let us bear in mind that when we ride too high we ride to a fall. Let us recognize also that when we expand unduly we are riding too high. If our plants and equipment are too great, it is not possible to contract much without unthinkable sacrifices.

The real lesson of the past catastrophe is the evil effect of over-expansion.

In the meantime there are some signs of encouragement at hand. A drive by the national, state and city governments has been started to provide work over the winter for the unemployed. Colonel Woods is at the head of President Hoover's Emergency Committee for Employment, the other members of which are Porter Lee, Bryce Stewart and Dr. Lillian Gilbreth. According to the latest National Business Survey Conference report, several industries showed an increase in September over August, such as building, shipbuilding, radio, bituminous coal, chemicals, electrical manufactures, leather and leather products, textiles, food products, exports and the retail trade. As a "long pull" measure European business men are seeking a parley with the United States to fight the depression which is world-wide.

We are not discouraged. But how many earthquakes do we need before we learn our lesson?

Man Versus Machines

THE last two or three years have seen a renewal of the agitation about the century-old question of the displacement of human power by machines. Seventy-five years ago in England, the hand weavers rose up and destroyed the new power looms which had thrown them out of work. Today this is unthinkable, but we still have, in a different degree, the same problem, which is now called "technological unemployment." Is our present unemployment problem due in part to the greatly increased use of automatic machinery?

An interesting pamphlet—"The Outlook for the Factory Worker," by Franklyn Hobbs of the Central Trust Company of Illinois, traces, statistically, the results of the greatly increased use of equipment from 1899 to the present time. His figures are very enlightening.

From 1899 to 1927, the total manufactured output in the United States rose from $11,500,000,000 to $62,000,000,000, or was multiplied by about 5.4. The number of workers in the same period rose from 4,700,000 to 8,300,000, or multiplied by 1.8. In other words, the workman of today, by the aid of improved machinery, produces three times as much as the man of 1899. Wages rose from $2,000,000,000 to $10,500,000,000; the wages per worker per year rose from $425 to about $1,300, or in other words, tripled, just as did the output per worker. The value added by manufacture rose from $4,800,000,000 to about $25,000,000,000. The value added by each worker rose from $1,025 to about $3,250.

The story told by these figures is simple and clear. The output of each worker has tripled in about thirty years and his pay has tripled. The number of workers has approximately doubled. The machine has displaced two men out of every three men, but this third man is now receiving the wages of all three, and in addition we have twice as many workers as we had in 1899. Instead of eliminating two out of three men permanently, the machine has found them new jobs and provided enough for many more.

Where have all these products of manufacture gone?

They have been consumed by the rising standard of living coincident with the reduced costs made possible by the use of machinery.

Periodically we have times of overproduction, unemployment and economic difficulty. However, it seems that the percentage of unemployment for any four-year period of the last twenty-eight years has been at about a par with any other four-year period. In other words, we have our periods of expansion and depression as before, but in the main, not because of the increased use of machinery.

The introduction of labor-saving machinery has never displaced workers as rapidly as new inventions and demands have created new jobs for them. Our rising standard of living provides new outlets for manufactured products and new jobs for the workers producing them. It may be that our period of plant expansion is over, for some time to come at least, but the end of increased consumption by a people striving unremittingly to raise their standards is not yet in sight.

Copper in the Ditch

COPPER is today selling at 9½ cents a pound. It seems only yesterday that it sold at 24 cents. The copper producers succeeded in holding their price for months at 18 cents in the face of increasing production, decreasing sales and consequently mounting stocks of metal. The bag finally became too heavy for them to hold and they had to let go at severe sacrifices. The first cut was from 18 to 14 and from there the descent has been steady, with scarcely an interruption.

It may be that the 18-cent price was too high. It certainly was if it allowed other metals to encroach upon the legitimate field of copper; but this we doubt, as there were no outstanding signs of it at any time. It is certain that 9½ cents is too low for the simple reason that most copper costs more than 9½ cents to produce and sell. Injured bystanders, wholly innocent in this tug of war, have suffered and are complaining bitterly, naturally enough. The brass manufacturer and the ingot maker have little interest in the price of the raw material, within a reasonable range, providing it remains fixed, but they do not like to be caught with inventories which have to be written off 50 per cent.

What is the answer? Is it a metal exchange on which the price will fluctuate daily? We doubt it. An exchange has its value, but under present conditions it can hardly be used effectively in the copper producing industry. The only permanent solution is intelligent regulation by which production is retarded with reduced demand, and vice versa. This could be effected by co-operative effort, by trade agreements within the law, and perhaps by the small necessary price revisions at the right time. Perhaps the reduction of a ¼ cent when copper stocks first began to mount would have warned the small and middle sized producers of the impending dangers and forced them to keep their production within bounds, just as the larger producers have had to do.

Obviously, the copper producers, powerful as they are, found it impossible to control the trade absolutely. There were large sources of copper which continued to ship at high rates. Probably the main American producers themselves continued to ship too long after the first signs of danger appeared. Whatever the reasons were, the problem is now without question a most drastic cut in production to stop the mounting supplies of metal. There is no such thing as the bottom of a market if stocks keep mounting.

With the lesson they have learned, copper producers should be in a position to apply the intelligent reasoning control which the copper industry needs.

Protective Devices for the Foundry Worker

THERE are several methods of maintaining safety in the plant. One of these, and probably the most important, is care by the individual worker. Another is the protective devices on machines. A third, in far too many cases overlooked, is the personal protective devices worn by the worker. In the foundry particularly these devices, such as shoes, gloves and goggles, are particularly important.

In a paper read by S. W. Doran, of the Pratt & Letchworth Company of Buffalo, N. Y., at a recent meeting of the National Safety Council, the author points out the importance of the various items of clothing which the foundryman must wear. Flask handlers and chainmen or hookers should always wear gloves. Grinders have no protection from bad burns, and chippers from sharp sprues, except gloves. Safety shoes should be worn by everyone in the foundry to prevent injuries from heavy pieces dropping on the feet. To be sure, this type of accident can be minimized by proper loading and hooking, but the feet must be protected in addition. Goggles must be worn by heat pourers and their helpers, also by chippers, grinders and, of course, welders.

Strangely enough, there are often objections on the part of the men to wearing special shoes and goggles. But there should be no weakening on the part of the company. If the man is so shortsighted as to prefer the risk of maiming or blindness to avoid a temporary discomfort, he should be prevented under orders from doing so.

Like many other factory problems, the effective operation of safety methods in a plant depends upon an adequate and inclusive set of rules, rigidly enforced, so that their maintenance becomes a habit.

George Westinghouse Memorial

MONDAY, October 6th, saw the dedication of the George Westinghouse Memorial in Schenley Park, Pittsburgh, Pa. It was the scene of tributes from a number of leading American figures to the great mechanical genius, who was born 84 years ago.

George Westinghouse was a mechanical and electrical inventor, who developed the air brake, switch and signal systems, derailed car restoration, a high-pressure combustion engine, a steam turbine and the alternating current system of electrical energy. He was not a metallurgist, primarily, but his inventions and manufactures not only made use of non-ferrous metals but literally depended upon them. It is needless to recount the manifold uses of metals in electrical devices as they are already well known. A fitting tribute to their importance is the brass foundry of the Westinghouse Electric and Manufacturing Company in East Pittsburgh, one of the largest of its kind in the United States.

George Westinghouse was a great inventor and industrialist. It is a privilege to any industry to have been able to aid him in any way.

Correspondence and Discussion

Chromium Tank Control

To the Editor of THE METAL INDUSTRY:

A very convenient chromium tank control is obtained by connecting a high resistance in series with field of generator having this resistance shunted out by a switch when desired, as shown by the accompanying drawing.

When plating a number of separate pieces, the rheostat is

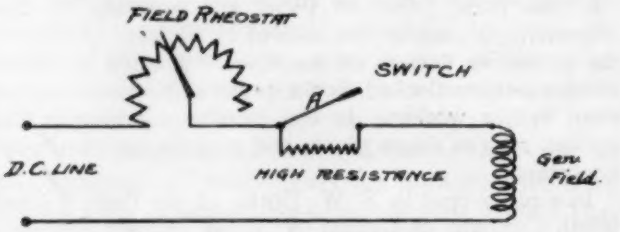


Diagram for Chromium Tank Control

set for the desired current, switch "A" is opened to remove the work, and when new work is all in the tank switch "A" is again closed. This gives exactly the same current as previously, with no special adjustments of rheostat and no current flowing while work is being taken to and from the tank.

We have found that this arrangement is very useful in our plant and no doubt it would prove very useful to other chromium plating departments.

MALLEABLE IRON RANGE COMPANY,
L. S. Weimer, Mechanical Superintendent.
Beaver Dam, Wis., October, 1930.

Chromium Plating Hazards

To the Editor of THE METAL INDUSTRY:

I am very much obliged for your kindness in sending us the proposed Chromium Plating Regulations which you printed in your valuable journal, September, 1930.

We fear that in this city chrome platers are not aware of the hazard involved. It is fortunate, however, that by attention to ordinary hygienic details much of the danger may be avoided. You are to be congratulated on giving your readers the benefit of this information.

N. Y. DEPARTMENT OF LABOR,
J. D. Hackett, Director, Bureau of Industrial Hygiene.
New York City, October, 1930.

Technical Papers

Conductivity and Density of Chromic Acid Solutions. Bureau of Standards, Department of Commerce, Washington, D. C. Obtainable from Superintendent of Documents, Washington, D. C., price 5 cents. Research Paper No. 198, by H. R. Moore and William Blum. Covers a step in an investigation of the theory of chromium plating.

An Investigation of the Magnetic and Electrical Properties of Some Iron Chromium Alloys, by Frederick Kapp Fischer, Rensselaer Polytechnic Institute, Troy, N. Y. Bulletin 28, Engineering and Science Series.

Investigation of the Thermal Conductivity of the System Copper-Nickel, by George F. Sager. Rensselaer Polytechnic Institute, Troy, N. Y. Bulletin 27, Engineering and Science Series.

American National Special Screw Threads. Bureau of Standards, Department of Commerce. Obtainable from Superintendent of Documents, Washington, D. C., price 15 cents. This is Commercial Standard CS25-30, giving tables of dimensions. Similar to it is Commercial Standard CS24-30, **American National Standard Screw Threads** (coarse and fine thread series); price 10 cents.

The Nickel Iron Copper System, by Peter R. Kosting; The Nickel Iron Chromium System, by Walter A. Dean. Rensselaer Polytechnic Institute, Troy, N. Y. Both papers in a booklet of 55 pages, 6 x 9; paper covered.

Nickel Iron Copper System: Alloys were prepared by melting electrolytic iron, electrolytic nickel and electrolytic copper in a vacuum furnace with 0.4 per cent addition of manganese, and also by melting Armco iron, electrolytic nickel, and electrolytic copper in a low resistance carbon pot furnace, making additions of 0.1 per cent aluminum, 0.5 per cent manganese and 0.3 per cent magnesium nickel alloy and chill casting. Pieces of each ingot were drawn to wire and the specific resistance at 20°C, temperature coefficient of resistance in the range 20° to 100°C, and thermo-electric force against copper were determined, and the results drawn up in ternary diagrams. The boundary of the immiscible area was found to be very close to previous determinations at higher temperatures. Iron additions decrease the good electrical properties of the nickel copper alloys. Copper additions to iron nickel alloys raise the thermoelectric force a small amount. Copper increases considerably the thermal expansion of Invar and raises the temperature at which rapid expansion occurs. Small additions of iron to non-magnetic copper nickel alloys make them magnetic.

Nickel Iron Chromium System: In the iron-nickel-chromium system, the properties of resistance to oxidation at 1000°C, hardness and electrical resistance were investigated as well as the x-ray, expansion and magnetostrictive characteristics of these alloys.

In determining the resistance to oxidation at 1000°C, a considerable section of the system was found in the region of greater iron and chromium content, not yet commercially exploited, which contained alloys with highly desirable properties. These would be less expensive than the present trade compositions. No alloys of appreciably greater resistivity can be expected from this system than those now commercially available.

The expansion characteristics of the alloys were investigated between 20° and 1000°C. X-ray examination showed that the dominant lattice is face centered. There is a smaller region where the body centered exists and also one where the two lattices coexist. The Rockwell hardness of these alloys was also determined.

Magnetostriction has been measured by means of a Michelson Interferometer. These measurements show that the magnetostrictively active alloys belong to the nickel-iron and nickel-chromium binary series and to those ternary alloys immediately adjacent to the binary series to which about ten per cent of the third component has been added.

American Standards Year Book—1930. American Standards Association, 29 West 39th Street, New York City. 103 pages, large size; free on request to the Association.

The American Standards Association is a federation of forty-three technical societies, trade associations and governmental bodies, for the purpose chiefly of bringing together manufacturers, distributors, consumers, technical specialists and others directly concerned with standization projects. The year book just issued covers the work of the association during the past year, contains the president's report, lists all projects, the membership, administration, cooperative relations, treats of industrial standardization, and lists all publications of the association. Naturally, the work of such a body to a great extent concerns metals and metal products.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

Aluminum Bus Bars

Q.—Please give me information regarding use of aluminum in place of copper for bus bars in electroplating. I wish to know how much heavier the aluminum must be than the copper; what the loss of amperage is per foot; and if oxidation is encountered when joints are made. We are installing two new generators and this information will be valuable to us.

A.—Aluminum bus bars from generator to tank have been used successfully in several electroplating installations that have come to our attention. Data on the subject follows:

Resistance:

Aluminum bus bar has a resistance approximately 1.6 times that of copper. To carry the same current with aluminum bus bars, therefore, requires 50 to 60% greater cross section than copper. Since aluminum weighs .3 as much as copper, the equivalent weight of aluminum to copper for the same current carrying capacity is $1.6 \times .3 = .48$. In other words, the weight of aluminum required is approximately half the weight of the equivalent of copper.

Determining the size of aluminum bus bars:

For distance 15 ft. or less, use 500 amps. per sq. in. of cross section, and for 20 to 50 ft., 320 amps. per sq. in. of cross section.

Costs:

At the current market price (about 10 cents), copper costs less than half as much as aluminum. The above equation therefore becomes: $1.6 \times .3 \times \frac{2}{1} = .96$. Aluminum bus bars, therefore, of carrying capacity equivalent to copper bus bars would cost a little less than copper bus bars. For example, for a 1500 ampere motor generator set, we recommend four 2" x ¼" copper bus bars for each polarity. For a distance of 15 ft. this would work out $8 \times 15 \times (2'' \times ¼'') \times 3.85$ (weight of 1 ft. of copper 1 sq. in. of cross section), making a total of 231 pounds. For the equivalent aluminum we could use bus bars either $3'' \times ¼''$ or $2'' \times ⅜''$. This would give us $8 \times 15 \times (2'' \times ⅜'') \times 1.15$, equalling 103½ lbs. of aluminum. At 25 cents a pound copper bus bars would cost $57.75. At 45 cents a pound the aluminum bus bars would cost $46.57. In addition, there will be a slight saving in transportation and handling charges on account of the lower weight of the aluminum bars. (Of course, copper happens to be low in price at present, while aluminum has not changed.)

Aluminum oxidizes much more rapidly than copper and, therefore, more care should be used in making joints. The best results for both aluminum and copper are obtained by cleaning the contact surfaces with emery or a scratch brush, while the surface is covered with vaseline and clamping the surfaces together under heavy pressure. Instead of vaseline, a mixture of red lead and linseed oil can be used. The lap should be 16 times the thickness of the bar and the clamping pressure should be not less than 750 lbs. per sq. in. The bolts on our standard bus bar clamps are sufficiently large to give the desired pressure. The resistance of a joint made in this way will be less than the resistance of the solid part of the bar, but will increase if the pressure is released and then reapplied without recleaning the joint. Inquiry among the manufacturers would indicate that some sizes of aluminum bus bars are carried in stock and other sizes may be secured in 3 to 4 weeks, or sooner if necessary.

A bulletin entitled "Aluminum Bus Bars" can be obtained from the Aluminum Company of America, Pittsburgh, Pa.

G. B. H., Problem 4,023.

Automobile Babbitt

Q.—Enclosed please find sample of scrap automobile babbitt poured into a small strip. We would thank you to advise us as to the reason for this metal being so coarse when it should be a smooth, silvery white color, with a yellowish tinge. Could you also advise us why it is that this metal, upon being remelted two or three times, loses its life? We would appreciate any information you can give us on the remelting of scrap automobile babbitt.

A.—Automobile babbitt for bronze back bearings is generally made as per SAE No. 10 and No. 11. This is approximately as follows:

Tin, min.	86.00
Copper	5.00 to 6.50
Antimony	6.00 to 7.50
Lead, max.	0.35
Iron, max.	0.08
Arsenic, max.	0.10
Zinc and aluminum	None
Bismuth, max.	0.08

When this metal is sweated off the bronze bearing, it takes some of the bronze metal with it and generally the bronze back is made of 85 copper, 5 tin, 5 zinc, 5 lead, and this is the cause of loss of color, etc. The babbitt is tinned on the bronze bearing and tin has an affinity for copper. Analysis will prove that there are variations between the virgin babbitt and the babbitt melted off bronze for the reasons stated above.

W. J. R., Problem 4,024.

Cadmium as Silver Deoxidizer

Q.—Will you kindly tell us the percentage of cadmium that should be used when sterling silver is melted, so that the cadmium will be most efficient as a scavenger and will not leave any traces of cadmium in the assay of the sterling silver?

A.—It would be impossible for anyone to state the percentage of cadmium which should be used for deoxidizing sterling silver and at the same time leave no traces of the cadmium, because the amount of cadmium required would be directly proportional to the oxides present.

The percentage of oxides contained would vary and the customary procedure would be to use a slight excess of cadmium over the maximum amount of oxides which would be present.

One-half of 1%, or 5 parts of cadmium per thousand, is an old formula which has been used by sterling melters for this purpose.

R. H. L., Problem 4,025.

Chilled Bronze Patents

Q.—We wonder if you can give us any information as to whether there are any patents covering chilled bronze castings, or patents covering the chills in which these castings are made.

A.—We do not know of any patents covering castings of bronze in chilled molds. There are, however, patents covering methods of casting bronze in chilled molds, such as gating, etc. These would have to be found through a patent search.

W. J. R., Problem 4,026.

Defective pH Comparator

Q.—I am sending you two bottles of nickel solution which I would like to have analyzed for pH, metallic nickel and chloride.

Solution in Bottle E-11 was made up from single nickel salts 8 oz., boric acid 1 oz., magnesium sulphate 1 oz., sodium chloride ½ oz., and one gallon water. This solution plates rather dark although pH tests show 6.0 (comparator set).

Solution in Bottle E-24 was made from 16 oz. single nickel salts, 3 oz. nickel chloride, 1 oz. salammoniac, 1 oz. boric acid, 1 oz. sodium chloride and 1 gallon water. I get a good deposit from E-24, except it pits occasionally with a pH 6.1.

A.—Analyses of nickel solutions:

No. E-11	Metallic nickel	2.78 oz.
	Chlorides	2.13 oz.
	pH	5.2
No. E-24	Metallic nickel	2.78 oz.
	Chlorides	1.85 oz.
	pH	5.2

If your comparator set gives you a reading of 6 for E-11 solution and 6.1 for E-24 solution, we would suggest that you purchase new tubes for the set. Your results are incorrect.

The pH of both solutions is too low and this is undoubtedly the cause of your trouble. We suggest that you add to each 100 gallons of both solutions, 10 fluid ounces of 26° ammonia.

O. J. S., Problem 4,027.

Insulators for Silver Ware

Q.—Will you kindly tell me where to purchase material for insulators for nickel silver and pewter tea ware? We want material which can be cut with cutting dies.

We are using a fiber which breaks down in the cutting, as you will see by the one inclosed. Is it the fault of the material or the cutting tool?

We also make insulators without the hole in them and use all shapes; we rivet metal pieces on each side so they can be soldered to the metal handles.

A.—The sample insulator sent in is made from a low grade rubber compound which, being friable, does not shear cleanly in the blanking process, leaving rough, uneven edges. Such a compound would, in our opinion, break down in use if subjected to continued heating.

We do not consider that the blanking tools are at fault but would suggest that after blanking, the discs be placed on an arbor and ground on a centerless grinder. If polished edges are desired, place polishing wheel alongside of grinder to complete in one operation.

Bakelite or hard rubber would give you a better looking and more serviceable material for insulators for your purpose. A source of supply can be readily found among the advertisers in THE METAL INDUSTRY. (See "Buyers' Guide" pages).

W. F., Problem 4,028.

Jewelry Casting Equipment

Q.—I would be very much gratified if you could furnish details as to where I could purchase a sand-casting outfit for white metal jewelry novelties.

A.—It is practically impossible to buy a sand-casting outfit for novelties in the open market. A machine for that kind of work has to be built up, and the casts made by an experienced man. William Dixon, Inc., 110 Fulton Street, New York, have a sand-casting machine for rings.

JEWELRY METALLURGIST, Problem 4,029.

Lead Sulphide and Coppered Mirrors

Q.—Will you please give me a formula for lead sulphide mirrors; also, formula for coppered glass mirrors.

A.—We are not familiar with what you call a "lead sulphide mirror." Possibly a little more definite information in regard to what you are aiming to do, or a sample of what you desire to reproduce, may enable us to help you solve your problem.

To produce copper-backed mirrors it is necessary first to coat the glass with metallic silver, using this as a base on which to deposit the copper. To produce the silver coat make the following two solutions:

No. 1.—To 8 ounces of distilled water brought to a boil add 12 grains of silver nitrate and 12 grains of Rochelle salts. Let it boil for 6 to 7 minutes, then cool and filter.

No. 2.—Take 8 ounces of distilled water, and into a small quantity of it put 19 grains of silver nitrate. Stir well until dissolved. Then add several drops of 26° ammonia until the solution becomes clear. Add 16 grains more of nitrate of silver, stirring well until dissolved. Add balance of distilled water and filter. The filtering must be done through a glass funnel in which the filter paper is placed. The solution must be stirred with a glass rod. Keep the solutions in separate bottles marked "No. 1" and "No. 2."

Clean the glass with ammonia and wipe with a wet chamois. Then take half and half of the two solutions in a graduating glass, stirring well with a glass rod. Pour the contents on the middle of the glass to be silvered. It will spread over the surface if the glass is laid flat. Leave it until the solution precipitates, which will take about two minutes.

This will give a coating of metallic silver which makes a suitable base for further metal deposits. To deposit a copper backing, use the following solution:

Copper sulphate	20 oz.
Sulphuric acid	10 oz.
Water	1 gal.

Use cold, with electrolytic copper anodes; 1 volt tension.

W. F., Problem 4,030.

Low pH in Nickel

Q.—Under separate cover we are mailing a sample of our nickel solution for analysis.

We are operating a 400-gallon solution in a jobbing way for both regular nickel finishes and for chromium finishes.

We have been having some trouble with our work peeling and we will appreciate your advice as to a remedy.

We operate the solution at about 75°.

A.—Analysis of nickel solution:

Metallic nickel	2.93 oz.
Chlorides	3.83 oz.
pH	5.4

Analysis shows that the pH is too low. We suggest that you add to the 400 gallons of solution, 30 ounces of 26° ammonia, and operate the solution at a temperature of 95° to 100° F., with a cathode current density of 15 to 20 amperes per square foot.

O. J. S., Problem 4,031.

New Jewelry Metal

Q.—We have been informed that there is a new green metal being used for making jewelry. We do not know what it is or who uses it, and are wondering whether you have as yet come in contact with anything of that nature. If so, will you kindly let us know what it is and where it may be obtained?

A.—We do not know of any metal that answers this description. Improved ways of making up green gold alloys are reported now and then, but these can hardly be spoken of as a new metal. Perhaps your informant is thinking of some new finish or lacquer of a green color. Perhaps if you could secure further details we could offer some information.

JEWELRY METALLURGIST, Problem 4,032.

Protecting Brass Plumbing

Q.—We manufacture ball cocks and are interested in learning whether there is a process whereby cast red brass of approximately 85-5-5-5 mixture, as well as commercial yellow brass rod and tubing, can be protected from the element usually found in city water systems. Can it be done by an inexpensive plating process? This item is highly competitive and the process must be very inexpensive.

A.—If you mean that the inside of the ball cocks and the brass tubes are to be protected, we advise that there is neither a practical nor an economical way to protect the brass by electroplating.

The outside, as you probably know, can be very well protected if given a good electro-deposit of nickel, followed with a coating of chromium.

G. B. H., Problem 4,033.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,759,450. May 20, 1930. **Method and Apparatus for Treating Hot Galvanized Articles.** Charles A. Giblin, Westfield, N. J., assignor, to Henry B. Newhall Corporation, Garwood, N. J.

A method of the class described which consists in subjecting a coated article to intermittent impacts in a confined channel, and moving said article in an irregular path through said channel whereby excess coating on said object is removed.

1,759,502. May 20, 1930. **Method of and Apparatus for Coating Articles.** James Scott George and Roger S. Sperry, Waterbury, Conn., assignors to Scovill Manufacturing Company, Waterbury, Conn.

In an apparatus of the class described, and in combination, a tank for a lacquer bath, supporting means for a shell, conveyor means on which the supporting means is pivotally mounted, for conveying the supporting means past the tank to cause the shell to be submerged in the bath.

1,760,028. May 27, 1930. **Process of Producing Metal Sheets by Electrodeposition.** Harry M. Williams and Robert G. Suman, Dayton, Ohio, assignors to General Motors Research Corporation, Dayton, Ohio.

The process of producing sheets of metal which comprises eletrodepositing the metal directly upon a chromium containing metallic surface and stripping the sheet so formed from said surface.

1,760,258 and 1,760,610. May 27, 1930. **Die-Casting Machine.** Marc Stern, Flint, Mich., assignor to A. C. Spark Plug Company, Flint, Mich., a Company of Michigan.

In a die casting machine, a movable melting pot member, a movable die member movable in the path of movement of said pot member, means common to said members to concurrently move them through the same path, connections between said means and the respective members, one of the connections including a motion modifying device, whereby the concurrent movement of the members is through different limits.

1,760,549. May 27, 1930. **Aluminum Alloy.** Truman S. Fuller and David Basch, Schenectady, N. Y., assignors to General Electric Company, a Corporation of New York.

The method of improving the tensile strength of a cast alloy which is substantially devoid of copper but contains more than 80% aluminum; at least about 6% zinc and at least about ½% magnesium, which consists in heating the alloy between 450° C. and 575° C., quenching the alloy and then aging it at a temperature of about 150° C.

1,760,603. May 27, 1930. **Method of Coating Metals.** Edwin R. Millring, New York, N. Y., assignor to American Machine & Foundry Company, a Corporation of New Jersey.

The method of covering metal with a protective metal coating, which consists in applying to the metal a coating alloy in super-cooled condition.

1,760,645. May 27, 1930. **Metal Foil.** Wilford J. Hawkins, Claiborne, Md., assignor to American Machine & Foundry Company, a Corporation of New Jersey.

Wrapping material comprising paper, and a facing of metal foil composed of lead containing from ¼ to ½ of 1% of magnesium and rolled to a thinness of approximately .0005".

1,761,116. June 3, 1930. **Composition for Soldering Metals.** Karl Geisel, Levallois-Perret, France, assignor, by mesne assignments, to Aluminum Solder Corporation of America, New York, N. Y.

A composition for soldering metals, particularly aluminum and its alloys, consisting of a mixture of zinc chloride, ammonium bromide and sodium fluoride.

1,761,506. June 3, 1930. **Method of Making Articles of Lead-Copper and Analogous Alloys.** Harry M. Williams, Dayton, Ohio, assignor to General Motors Research Corporation, a Corporation of Delaware.

A method of making bearings or other articles containing a homogeneous mixture of copper and lead, which consists in compressing solid particles each composed of a copper-lead mixture into the form desired, then heating the blank thus formed in a non-oxidizing environment until the particles cohere.

1,761,850. June 3, 1930. **Process for Coating, Impregnating, or Alloying Metals and other Materials with Aluminum and Aluminum Alloys.** Walter Smith, West Hartlepool, England, assignor to The Expanded Metal Company, Limited, London, England. A process of impregnating a foundation article with a surface alloy of a substance comprising aluminum, which consists in first treating the article with cadmium and then treating the article with a substance comprising aluminum, the second treatment being carried out at a temperature below 900° C.

1,761,186. June 3, 1930. **Process of Treating Ferrous Metal Articles.** Marlin C. Baker and Wilbert A. Dingman, Detroit, Mich., assignors, by mesne assignments, to Parker Rust Proof Company, Detroit, Mich.

The process of treating articles having surfaces of ferrous metal, which comprises heating said articles to a temperature of about 500° to 550° F., immersing the heated articles in a rust-proofing solution, then removing said articles from said solution and baking at a temperature of about 325° to 450° F.

1,761,936. June 3, 1930. **Method of Rust-Proofing Iron or Steel.** Alfred W. Schluchter, Dearborn, Mich., assignor to General Motors Research Corporation, Detroit, Mich., a Corporation of Delaware.

The process of treating iron or steel so as to produce on the surface thereof a corrosion resisting coating which includes heating the metal in an atmosphere of a gas capable of reacting with the metal so as to form thereon a surface coating and containing a substance selected from the group which consists of the elements of Group V (B), and Group VI (B) of the periodic system and the compounds of said elements from which the elements will be freed at the temperature of the heating.

1,761,948. June 3, 1930. **Electroplating Process.** Ralph J. Wirshing and Henry R. Faas, Detroit, Mich., assignors to General Motors Research Corporation, Detroit, Mich., a Corporation of Delaware. The process of electrolytically depositing nickel comprising passing an electric current through a bath containing as it principal solute nickel acetate and including the maintenance of the bath during electrodeposition at a temperature between the approximate limits of 100° to 160° F.

1,764,034. June 17, 1930. **Alloy.** John V. O. Palm, Cleveland Heights, Ohio, assignor to The Cleveland Graphite Bronze Company, Cleveland, Ohio.

An aluminum bronze alloy comprising 85 to 90 per cent of copper, about 4 per cent of aluminum, 5 to 8 per cent of zinc, and 1 to 2 per cent of iron.

1,765,862. June 24, 1930. **Metal-Coated Paper Article and Method of Making Same.** Albert L. Clapp, Danvers, Mass.

A method which comprises forming paper comprising a material capable of reacting with a reagent to produce a hardening compound, treating the paper with the reagent, applying electro-conductive material to the surface of the paper, moulding the paper under pressure at an elevated temperature into an article of the desired shape, and then electro-depositing a metal on the article.

1,766,871. June 24, 1930. **Lead Alloy.** Sydney Beckinsale and Herbert Waterhouse, Woolwich, London, England.

A cable sheathing formed from a lead alloy containing from 0.10 per cent to 2 per cent cadmium and 0.25 per cent to 5 per cent metal from the group consisting of tin and antimony.

1,767,011. June 24, 1930. **Alloy.** Charles Pack, Brooklyn, N. Y., and Joseph C. Fox, Toledo, Ohio, assignors to Doehler Die-Casting Co., a Corporation of New York.

An alloy comprising in combination, a zinc base in excess of 75 per cent, aluminum within the range of 1 to 15 per cent, copper within the range of 1 to 10 per cent, nickel less than 5 per cent, and lithium in appreciable amount less than 5 per cent.

1,767,253. June 24, 1930. **Continuous Automatic Cleaning and Plating Machine.** Constantine G. Miller and Charles Franklin Cleveland, Chicago, Ill., assignors to The Meaker Co., Chicago, Ill.

A conveyor system comprising a pair of spaced parallel endless chains, a portion of the pathway described by said chains being vertical, hanger bars propelled by said chains at fixed intervals therein, sprockets for said chains having cut-out portions to receive the ends of said bars, and a second pair of vertical chains adapted to hold said bars against the first pair of chains during the vertical downward movement thereof.

1,767,764. June 24, 1930. **Mold Wash.** Augustus E. Kayes and Fritz Moehling, Huntington, W. Va., assignors to The International Nickel Company, Inc., New York, N. Y.

A coating or wash for molds for casting nickel or nickel alloys with copper, chromium, iron, or manganese, in which the nickel constitutes at least 30 per cent of the alloy, comprising a mixture of powdered silicon and a vehicle therefor.

1,769,188. July 1, 1930. **Automatic Plating Machine.** Hector Rabezzana, Flint, Mich., assignor to A C Spark Plug Company, Flint, Mich.

In an organization suitable for use in chromium-plating numerous separate pieces: a pair of pulleys so formed and positioned as to permit the interposition of a tank therebetween; a belt, including conductive material and extending over said pulleys, one lap of said belt passing above said tank and a return lap thereof passing below said tank; and work-receiving elements so secured to said belt as to extend upward from said return lap, favorably to the positioning of pieces to be plated thereon.

1,769,363. July 1, 1930. **Method and Means for Producing Metallic Coatings on Articles Such as Type Forms and the Like.** Nils Arvidson, Chicago, Ill.

The herein described method of coating articles with metal which includes the provision of a substantially constant feed of a relatively small stream of metal in a molten state, and mechanically knocking this stream of metal into infinitesimal particles and the impelling of these particles, still in molten condition, upon the article to be coated.

1,769,659. July 1, 1930. **Electrodeposition of Rubber.** William Arthur Williams, Edinburgh, Scotland.

A process for the electro-deposition of rubber or homologous substances from latex, which consists in the addition to the latex of a metallic salt without effecting coagulation of the latex, and thereafter subjecting the salt to electrolysis in the presence of an anode electrode of the same metal as the salt.

17,722 Reissue. July 8, 1930. **Method of Protecting Metal-Coating Baths and Composition Therefor.** Edwin R. Millring, Newark, N. J., assignor to American Machine & Foundry Company, a Corporation of New Jersey.

A composition of matter for protecting the surface of molten metal coating baths against oxidation, which consists of a mixture of rape seed oil and a petroleum product possessing a fire point in excess of 350° C.

The method of protecting the surface of a molten bath of coating metal to be applied to articles to coat the same, and requiring for its application a relatively high temperature, which consists in superposing on the surface of the metal bath, a protective bath consisting of a mixture of 98 per cent of rape seed oil and 2 per cent of insulatum.

1,769,986. July 8, 1930. **Process of Refining (Degasifying and Deoxidizing) of Copper.** Michael George Corson, Jackson Heights, N. Y.

A process of purifying copper which comprises forming a bath of metal, oxidizing any sulfur present to sulfur dioxide, and then lowering the pressure upon the surface of the bath to a point substantially below atmospheric, and maintaining such condition until the sulfur dioxide has been removed.

1,770,177. July 8, 1930. **Production of Coated Metallic Objects.** Edwin D. Martin, Washington, N. J.

The process of depositing one metal on another which consists in circulating volatilized salts of such metals in a path including said metals at different points therein, maintaining the temperature at the place in said path where the metal to be coated is located at such a point as to effect a chemical reaction between such metal and a volatilized salt of the metal to be deposited, and maintaining the temperature at the point in said path where the metal to be deposited is located at such a point as to effect a chemical reaction between such metal and a volatilized salt of the metal to be coated, substantially as described.

1,770,540. July 15, 1930. **Spot Welding of Brass and Aluminum.** Ernest Lunn, Chicago, Ill., assignor to Pullman Car & Manufacturing Corporation, Chicago, Ill.

The process of spot-welding together sheets of metal of low specific electrical resistance which consists in initially introducing a film of viscous liquid between the metal to be welded, applying pressure to the sheets at the welding area, and passing an electric current from one piece to the other at the point of application of pressure.

1,770,828. July 15, 1930. **Art of Protectively Treating Metals.** Arthur Arent, Des Moines, Iowa, assignor to Arthur Arent Laboratories, Inc., Des Moines, Iowa.

The process of protecting against corrosion metal surfaces electropositive to antimony group metals which comprises providing such a surface with an adherent protective coating containing a metal of the antimony group by contacting with said surface a solution of an antimony group metal salt in a substantially non-aqueous liquid solvent thereof until said coating is formed, said solution being substantially without free acid content corrosive to said surface.

1,771,899. July 29, 1930. **White-Metal Alloy.** Hubert James Rumley Overall, Bondi, Australia.

An alloy consisting of lead, antimony, tin, and copper in which the antimony represents about 12 per centum by weight, the tin about 12 per centum, the copper from 6 to 7 per centum, and the lead constitutes the remainder.

1,771,910. July 29, 1930. **Process of Protecting Surfaces of Aluminum or Aluminum Alloys.** Guy Dunstan Bengough and John McArthur Stuart, London, England.

A process of producing a resistant coating by oxidation on a surface predominantly of aluminum, which process consists in washing the surface with a solvent for grease and then in hot water, making the washed surface the anode in an electrolytic bath consisting of an aqueous solution of chromic acid of 3 per cent strength and containing a carbon cathode, maintaining the temperature of the bath at a temperature not less than 40° C., raising the voltage across the bath to about 40 volts in the course of about 15 minutes, keeping the voltage at this value for about 35 minutes, then raising the voltage to about 50 volts in the course of about 5 minutes and keeping it at this value for about 5 minutes and then washing and drying the surface.

1,772,074. August 5, 1930. **Method of Producing Galvanic Coatings.** Victor Engelhardt, Berlin-Charlottenberg, and Kurt Illig, Berlin-Wilmersdorf, Germany, assignors to Siemens & Halske, Aktiengesellschaft, Siemensstadt, near Berlin, Germany.

The method of producing a galvanic chromium coating on a hollow body, which consists in dipping the hollow body into an electrolyte suitable for chromium deposition, in such a manner that said electrolyte will be in contact with the inner surface and with the lower end of the said hollow body, placing within said body an anode which is a small fraction of the length of said hollow body, passing an electric current from said anode through the electrolyte to said body, the latter serving as a cathode, and effecting relative movement of anode and cathode lengthwise of said hollow body, the anode, at the beginning of such movement, being adjacent to the lower end of said body, and adding quantities of the electrolyte to keep the level of the electrolyte a small distance above the upper edge of the said anode.

1,772,490. August 12, 1930. **Casting Magnesium and Alloys Therefor.** Horace Kelley, Midland, Mich., assignor to The Dow Chemical Company, Midland Mich.

A method of casting a readily oxidizable metal, which includes the steps of heating and substantially saturating a porous-surfaced mold part with a substantially non-oxidizing gas, and casting the molten metal in contact therewith.

1,772,840. August 12, 1930. **Method of and Means for Electro-plating.** William S. Murray, Utica, N. Y., assignor to Oneida Community, Limited, Oneida, N. Y.

The combination with an electroplating circuit including as a cathode the article to be plated, of means for periodically decreasing and increasing from one uniform value to another uniform value the density of the current passing through said cathode at regularly controlled intervals while maintaining the same sign of polarity of said current.

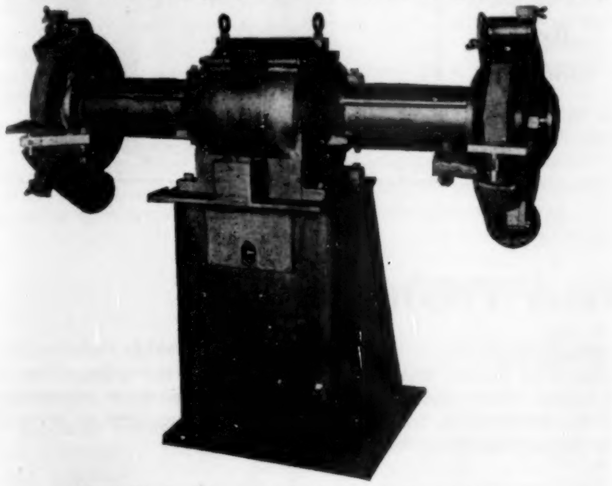
Equipment

New and Useful Devices, Metals, Machinery and Supplies

New Grinder

The Production Equipment Company, Cleveland, Ohio, announces the completion of all factory and field tests on its "One Profit" heavy duty type extended spindle grinding machine.

The specially constructed, powerful electric motors, designed by and built in the company's own plant, are completely enclosed, require no ventilation, and dirt, dust, grit or any foreign substance are prevented from entering the motor. These motors have been fully tested and will operate well within the standard temperature limitations, it is stated.



New Heavy Duty Extended Spindle Grinder

Four heavy duty ball bearings, two in each extended arm, provide strength and rigidity to the extra heavy nickel steel spindles. The greatest part of this grinder, especially base and accessories, is constructed of steel shapes, formed and welded. Useless weight has been discarded without sacrificing strength or rigidity.

The addition of the extended arm type grinder, completes the line of "One Profit" machines applied to any requirement, it is stated. Bulletins giving complete details of mechanical construction may be secured by our readers from the manufacturers.

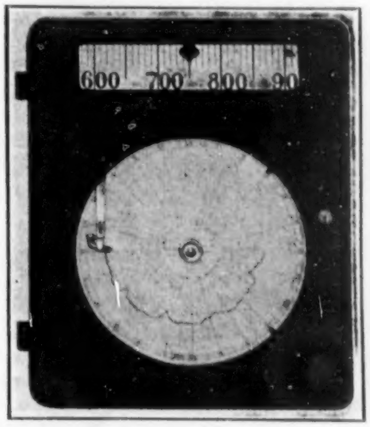
New Recording Pyrometer

A new type of instrument for measuring and recording temperature has been developed by the Uehling Instrument Company, 31 Vesper Street, Paterson, New Jersey. This instrument is known as the "Self-Contact" potentiometer pyrometer. It was primarily designed for measuring high temperatures as experienced in the iron, steel and ceramic industries. It lends itself equally well, however, to the measuring and recording of any temperatures where a high degree of accuracy is desired, the makers state. Either a thermo-couple or an electric resistance bulb may be used as the temperature element. The instrument is said to entirely eliminate the use of depressor bars, cam mechanisms, and continuously operating motors. This is made possible by a patented method which assures definite and reliable contact between the needle of a galvanometer and stationary contact pieces, without employing auxiliary mechanical devices which might conflict with the indicating needle.

Although the new instrument retains all the advantages of the potentiometer, the novel contact method permits placing the galvanometer apart, and at almost any distance from the recorder, it is stated.

The entire recording mechanism is fastened to a frame which is hinged to the case. Everything may be opened up to permit accessibility to all parts of the apparatus. A small motor operates only as and when necessary to adjust the pen to the proper temperature reading on a clock driven chart. It is also in geared connection with two pulleys over which a translucent endless belt about 2 ft. long is placed. The belt is calibrated in temperature units and will move in direct proportion to the pen mechanism but at a greater speed. This permits an open and legible scale which moves in back of a pointer fastened to the door. The legibility of the figures, the exceptional length of the scale, and the fact that it is illuminated from the rear, make it easily read at a distance of 75 ft.

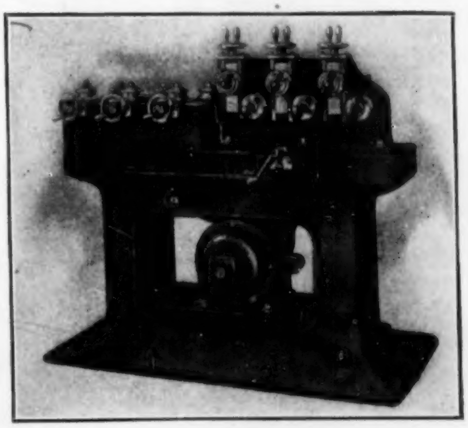
New Type Recording Pyrometer



Brass Tube and Rod Straighteners

A series of machines for straightening brass tubes and rods is manufactured by The Torrington Manufacturing Company, Torrington, Conn. These machines are made in twelve sizes for a variety of work. They have either twelve or sixteen rolls, depending upon the work for which they are designed, and have different capacities in other respects.

These machines are used to straighten rods and tubes in round, square or hexagonal shapes by passing them through a series of grooved rolls, all driven, in staggered arrangement in each of two planes. The operation is said to be rapid and to require a minimum of attention by the operator when rolls are properly set. Rolls are of crucible machinery steel, accurately machined for size. Outboard supports provide ruggedness. Hardened rolls are supplied upon specification. Half the rolls of each machine are adjustable by hand wheels.



Straightening Machine for Brass Tube and Rod

Either belt or motor drive may be applied to the machines, motors, when used, being placed within the pedestals of smaller

sizes and on bed plates of larger units, conserving floor space. All gearing is cut from solid, and fully guarded; bearings are bronze throughout, with ample lubricating facilities.

These machines may be had in modified designs for special work. Complete details regarding this equipment may be had by readers upon application to the manufacturer.

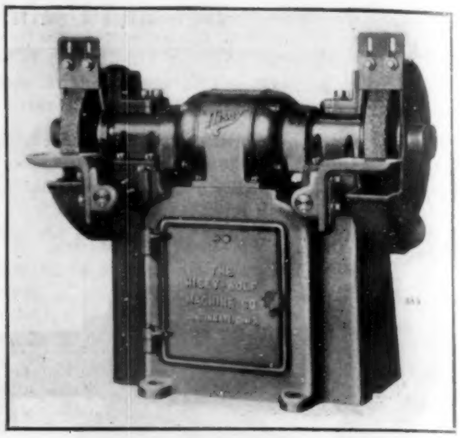
Heavy Duty Grinders Improved

A number of improvements in its line of 5, 7½ and 10 horsepower grinders is announced by the Hisey-Wolf Machine Company, Cincinnati, Ohio. The improved models supersede the types shown in this company's catalog 40 and 40-M, on pages 8 and 9. The redesigning of these grinders resulted in the addition of adjustable steel plate guards and heavy steel tool rests which are adjustable as well as removable. There is now a larger door for access to motor starter, larger spindle, and larger bearings. All feed wires are now encased in flexible metal conduit.

The grinders have the following descriptions: 5 horsepower, 18 x 3 x 1½ inch hole wheel, runs at 1140 r.p.m. speed no load, 43 inches between wheel centers, 34½ inches from floor to spindle, 1,650 pounds net weight; the 7½ horsepower machine uses wheels 20 x 4 with 1¾ inch hole, runs 1140 r.p.m. no load, has 44 inches between wheel centers and 34½ inches from floor to spindle, and weighs 1800 pounds; the 10 horsepower machine uses wheels 24 x 4 with 2¼ inch hole, runs 900 r.p.m. no load, has 44 inches between wheel centers and 34½ inches from floor to spindle, and weighs 2000 pounds. The illustration shows this type of grinder.

Readers may have complete information upon application to the Hisey-Wolf Company.

New Hisey-Wolf Heavy Duty Grinder



Flexible Copper Water Tubing

A new type of water tubing, especially adaptable to replacement and repair work in industrial plants, is being manufactured by the Chase Brass and Copper Company, Inc., Waterbury, Conn. The tubing is made of soft copper which can be run between walls and around corners like electric wiring without breaking walls very much and with a minimum number of joints, elbows, etc. It is stated to be sufficiently hard to withstand denting or flattening and to sustain 3,000 pounds of water pressure. Freezing water expands it without cracking it, and it will stand heat up to 400° F., according to the makers. Rustproof 99.9% deoxidized copper is used. Economy is said to be due to use of long lengths, elimination of excessive wall and floor breakage; the makers claim it is cheaper than any other kind of water pipe. The use of copper tubing and flanged fittings is new in water conveyance, but for locomotives, boats and automobiles it has been in universal use for a long time, the makers point out.

Photo, Courtesy Chase Brass and Copper Company

This picture gives some idea of the number of fittings that can be saved by bending Chase Copper Water Tube. Rigid pipe would require innumerable fittings and pipe threading to work-in similar bends.

Equipment for installation of this type of water pipe consists of hammer, hacksaw, reamer or file, wrench, and a special flanging tool. The tubing is supplied in coils of 45 feet in diameters of ⅜ to ¾ inch; and in straight lengths of 20 feet, diameters of 1 to 2 inch. A large variety of fittings for all purposes, including valves of many kinds, are provided.

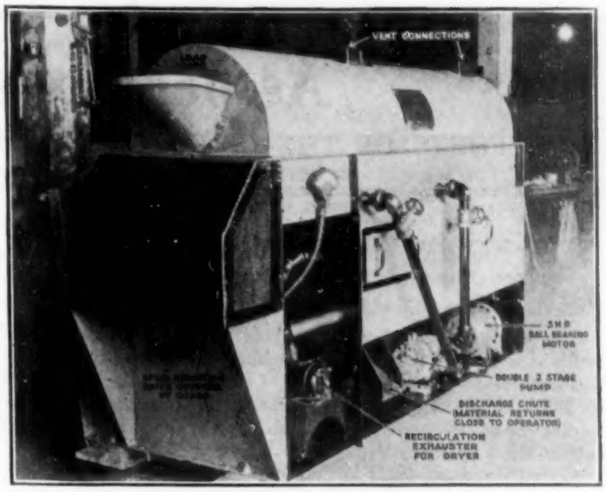
Automatic Cleaning and Drying Machine

The Metalwash Machinery Company, Inc. 117 East 24th Street, New York City, has constructed a rotary washing, rinsing and drying machine which is said to have unique, rugged, efficient and compact design, requiring only 40 sq. ft. of floor space. It is claimed the machine performs three distinct functions with the aid of only one operator. It can also be utilized as a separate washing or rinsing or drying machine or in any combination thereof.

This combination unit lends itself to cleaning and removing foreign liquids, chips, grit and dirt from screw machine parts, stampings, etc., as required before or after barrel plating, burnishing, acid dipping, etc., preparatory to further subsequent factory operations. It has a large production capacity and will take any size parts up to approximately two cubic inches, or equivalent, approximately 5 inches long.

The material is dumped by the operator into a loading chute where it is guided by a helical screw past wash and rinse sprays. After a suitable wash and rinse period, it is automatically discharged into the dryer drum from which the material is returned clean and dry through a side chute close to the operator. (See illustration.)

The machine is completely equipped with accessories and motors for pump, hot air recirculating exhauster and drive, requiring a total of 6½ horsepower, and heating equipment for either steam, gas or electricity. A variable speed transformer may be added to obtain variety of production speeds.



"Metalwash" Cleaning and Drying Machine

A number of these machines are in successful operation and have been favorably commented upon by their users, the makers state.

Equipment and Supply Catalogs

Link-Belt Promal Chains. Link-Belt Company, 300 West Pershing Road, Chicago, Ill. Booklet on chains for machinery drives.

Look to Weaver for all Pickling Needs. The Weaver Brothers Company, Adrian, Mich. Leaflets on pickling equipment and supplies.

Two-Piece Acorn or Cap Nuts. Detroit Plating Industries, 1033 Mt. Elliot Avenue, Detroit, Mich. Leaflet on cap nuts for concealing bolt-ends.

Welding of Monel Metal and Pure Malleable Nickel, by N. C. Marples, M. Sc. Alloy Welding Processes Limited, Ferry Lane Works, Forest Road, London, E.17, England.

Foxboro Steel Spring Recording Gauges. The Foxboro Company, Foxboro, Mass. Bulletin 168 on gauges with steel springs and all-welded movements. Completely illustrated.

Center Retort Underfeed Stoker. Combustion Engineering Corporation, 200 Madison Avenue, New York City. Catalog E-7 on the Type E stoker; equipment for large furnace operation.

Flexible Grinding and Polishing of Metals. Norton Company, Worcester, Mass. An interesting booklet showing advantages of 'flexible grinding" which the company feels is a better term for describing what is generally called "polishing" in the metal trades.

Hanson-Munning Plating Barrels. Hanson-Van Winkle-Munning Company, Matawan, N. J. Bulletin M-104, describing "Mercil" type plating barrels. A completely illustrated, excellently prepared catalog, giving all necessary technical data on this equipment.

Nickel in the Brass Foundry. The International Nickel Company, 67 Wall Street, New York City. A brief resume of some of the applications of nickel to brass alloying. Gives properties of nickel-bearing compositions briefly; good illustrations showing products made of bronzes containing nickel.

General Electric Company, Schenectady, N. Y., publications: Low-Speed Synchronous Motors; Direct-Heat Electric Furnaces, box-type, Type RRB, for heat-treating, carburizing and annealing metals, firing vitreous enamel, annealing glass, and other heating operations up to 1850° F.; G-E Welding Electrodes.

The Cleaning of Metal. Magnus Chemical Company, Garwood, N. J. A 76-page book by R. W. Mitchell, Ph.D., on processes, methods and materials for metal cleaning, with practical suggestions for their application. The book is a good technical treatise on the subject, written for the practical man as well as the engineer. It is illustrated, covers the equipment needed for modern cleaning practice, explains theory as well as application in plant and shop. It is well printed on good paper and deserves attention from anyone interested in keeping up with the latest information on this very important phase of metal fabrication.

Power Presses and Allied Equipment. The Waterbury Farrel Foundry and Machine Company, Waterbury, Conn. A 303-page book bound in leatherette. Details of many kinds of cutting-up shop machinery, including single and double acting crank presses; multiple plunger presses; knuckle joint or toggle presses; foot and screw presses; shearing presses and slitters; press attachments; lathes for shells, including thread and rolling machines. The book has a comprehensive index and a general classification of the machinery manufactured by the company. Complete technical data, tables of specifications, power requirements, etc., are given. The book is a valuable adjunct to the information files of metal fabrication plants and purchasing departments. The format, that of a regular bound book, makes it particularly easy to use.

Crown Plating and Polishing Equipment and Supplies. Crown Rheostat and Supply Company, 1910 Maypole Avenue, Chicago, Ill. A beautifully prepared catalog of 271 pages, 7¾ x 10½ inches, bound in boards covered with aluminum foil. The catalog is profusely illustrated and completely supplied with descriptions, specifications, applications of the products offered, etc. A good list of plating and finishing chemicals gives such information as chemical symbols for these, color, form, grades, sizes of standard containers. Not the least valuable part of the book is a large section devoted to an outline of equipment needed for a metal finishing plant, care of equipment, layout of floors, electromotive data, properties of metals, current required for various types of deposit, and an electroplater's formulary giving numerous solutions for cleaning, finishing and electroplating. The book is concluded by an adequate index which makes it a simple matter to find any equipment, supplies or general information in the book. It is worthy of a place in every plating or finishing plant or department. Distribution is limited to executives requesting the book on firm stationery.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

American Foundrymen's Association

HEADQUARTERS, 222 WEST ADAMS STREET, CHICAGO, ILL.

Chicago for 1931 Convention

Announcement has just been made by the American Foundrymen's Association that the 1931 annual meeting of the association will be held at the Stevens Hotel, Chicago, Ill., the week of May 4, 1931. This announcement follows the unanimous vote of a special committee appointed to consider the question, in a meeting held at the Hotel Statler, Buffalo, October 17.

The decision was reached as the result of the unanimous opinion held by the committee that, all things considered, the accommodations available at the Stevens Hotel were superior for this meeting to those offered by other cities whose invitations were presented. The proposal of the Stevens Hotel includes a 50 per cent increase in exhibit space over that used for the A. F. A. convention in 1929, and two additional meeting rooms in the hotel tower, seating 200 and 300 persons, respectively.

As announced at the meeting by Chairman N. K. B. Patch, Lumen Bearing Company, Buffalo, N. Y., and president of A. F. A., a limited exhibit of foundry equipment and supplies was scheduled for the 1931 meeting, following the policy established in 1929. The committee also were unanimous in feeling that it is essential to the success of conventions with limited exhibits that all activities of convention week be housed in one building.

Coupled with the decision of the special committee to meet in Chicago next year was the recommendation that the 1932 annual meeting be held in Philadelphia and that an option be secured on the new Philadelphia Convention Hall, now under construction, for a convention and large exhibit the first full week in May, 1932. It was further recommended by the committee that in the future all annual meetings of the American Foundrymen's Association be scheduled for the first full week in May.

In addition to President Patch, and Vice-President E. H. Ballard of the General Electric Company, West Lynn, Mass., the following members of the special committee attended the meeting:

L. L. Anthes, Anthes Foundry, Ltd., Toronto.

B. H. Johnson, R. D. Wood and Company, Philadelphia.

Frank J. Lanahan, Fort Pitt Malleable Iron Company, Pittsburgh.

H. W. Standart, Northern Engineering Works, Detroit.

S. W. Utley, Detroit Steel Casting Company, Detroit.

S. C. Vessy, W. W. Sly Manufacturing Company, Cleveland.

Executive Secretary C. E. Hoyt, Chicago, member ex-officio.

Formulating Program for 1931 Convention

In preparation for the coming Chicago convention, the various sub-committees of the Program and Papers Committee all report that a full schedule of sessions, shop-operation courses and round-table luncheon meetings are planned. In addition, the papers on new foundry developments promise one of the most interesting conventions ever held, for foundrymen in all branches of the industry.

To the shop-operation courses on steel, gray iron and non-ferrous shop practice held in the past, two more courses will be added in 1931—on malleable foundry practice and sand control. It has become evident that these courses, organized particularly for the purpose of giving practical instruction in shop practice fundamentals, fill a distinct need, and the schedule for 1931 will be arranged more carefully and thoroughly than ever before.

Personnels of the gray iron and malleable shop-operation committees already have been selected, and the non-ferrous, steel and sand control committees are being organized rapidly.

The general sessions and round-table luncheon meetings will complete the program, which will start on Monday afternoon of convention week, continuing through Thursday. As at the Cleveland meeting last May, three round-table groups will be held, to deal with malleable, steel and non-ferrous founding.

American Electroplaters' Society

Philadelphia Branch

HEADQUARTERS, CARE OF PHILIP UHL, 2432 N. 29th STREET PHILADELPHIA, PA.

Annual Banquet November 22

The annual banquet and educational session of the Philadelphia Branch of the American Electroplaters' Society will take place Saturday, November 22, 1930, at McAllister's Hall, 1811 Spring Garden Street, Philadelphia.

The banquet will take place in the evening. A good orchestra and other entertainment will be provided. Platers from all branches are invited to attend.

All those desiring tickets to the banquet should communicate with George Gehling, 5001 Tulip Street, Philadelphia, Pa.

Dr. H. S. Lukens will be chairman of the educational session. He is preparing an excellent program.

Among the speakers listed are Dr. William Blum of the United States Bureau of Standards, Washington, D. C., who will give a talk on "Chromium Plating."

Floyd Taylor of the Bullard Company of Bridgeport, Conn., will give a talk on the "Dunn Process of Electro-Pickling."

Dr. A. K. Graham of the University of Pennsylvania will give a talk on "Educational Classes for the American Electroplaters' Society."

There will also be one or two papers on cadmium and zinc plating.

The new Research Associate of the American Electroplaters' Society will be introduced to the members at this meeting.

The chairman of one of the Sub-Committees of the American Society for Testing Materials will be present at the session. Recently that organization held a Symposium on Corrosion. The representative at the coming session intends to gain chiefly a knowledge of electroplated coatings from the standpoint of the practical plater.

The Branch has cut down its program to four or five papers so as to give more time to the discussions of the papers presented; in previous years the Branch has had too many papers and could not give the proper time for discussion.

New York Branch

HEADQUARTERS, CARE OF J. E. STERLING, 2581 FORTY-SIXTH STREET, ASTORIA, LONG ISLAND, N. Y.

October Meetings

The New York Branch held regular meetings on October 10 and 24, at the meeting room, 611 Pulitzer Building, Park Row, New York City. Papers were heard on several phases of electroplating, including one on "Deplating of Aluminum for Coloring Purposes." Full details were given, including discussion of various kinds of aluminum castings and dips for them. Difficulties in nickel plating of various metals provided discussion also.

The New York Branch plans to hold "Good and Welfare" meetings the first Friday evening of each month, beginning November 14, when an invitation meeting will be held. The Branch is preparing tickets which members will be permitted to distribute to foreman platers. A good speaker will address the members and their guests.

ARTHUR GRINHAM, Recording Secretary.

International Acetylene Association

HEADQUARTERS, 30 EAST 42ND STREET, NEW YORK CITY

Welding in Metal Working

A session on oxy-acetylene welding in the metal working industries will be a feature of the Thirty-first Annual Convention of the International Acetylene Association which will be held in the Congress Hotel, Chicago, Ill., November 12, 13, 14, 1930.

The Metal Work Industries Session is scheduled for 2 P. M., Wednesday, November 12, with Mr. C. A. McCune, President of the International Acetylene Association, presiding. Among the papers to be presented at this session are the following:

"Production Welding by the Oxy-Acetylene Process," by C. E. Booth, Noblitt-Sparks Industries, Inc., Indianapolis, Ind.

"Production Welding by the Oxy-Acetylene Process," by L. H. Gurley, Editor "Welding," Pittsburgh, Pa.

"Oxy-Acetylene Committee Report," by E. A. Doyle, The Linde Air Products Company, New York City.

American Electrochemical Society

New York Section Meeting

HEADQUARTERS, CARE OF RESTON STEVENSON, THE COLLEGE OF THE CITY OF N. Y., NEW YORK CITY

The regular autumn meeting of the New York Section of the American Electrochemical Society will be held on Friday, November 21, at 8 P. M., in No. 309 Havemeyer Hall, Columbia University, New York City. The public is invited to this meeting. The following program has been arranged:

Dr. Beverly L. Clarke, of the Bell Telephone Laboratories, will give his methods and results in regard to "Potentiometric Titrations in Non-Aqueous Solvents."

Prof. Dwight K. Alpern, formerly of Swarthmore College, will give an experimental lecture upon "Photo-Voltaic Cells."

These novel electrolyte photo-electric cells will be demonstrated, their striking practical uses shown and their operation compared with ordinary photo-electric cells.

Columbia University has extended to the Society the privileges of the Faculty Club at 118th street and Morningside Park West, New York City, where an informal dinner at 6:45 P. M. will precede the meeting. Members of the American Electrochemical Society and their guests are invited to the dinner; one dollar and a half the cover.

RESTON STEVENSON, Secretary-Treasurer.

Ornamental Bronze Manufacturers

HEADQUARTERS, 1331 G STREET, N. W., WASHINGTON, D. C.

Annual Meeting at Baltimore

The National Association of Ornamental Iron, Bronze and Wire Manufacturers held its 23rd annual meeting October 14, at Baltimore, Md., with about 250 attending.

Delegates to the convention pointed out that new fabrication methods and new alloys have tended to increase materially the architectural use of metals for both interiors and exteriors of many kinds of buildings. Leaders in the industry declared the trend toward metals in architecture is in its infancy and will steadily gain.

Copper and Brass Research Association

HEADQUARTERS, 25 BROADWAY, NEW YORK CITY

R. L. Agassiz, chairman of the board of the Calumet and Hecla Consolidated Copper Company, was re-elected president of the Copper and Brass Research Association at its tenth annual meeting on October 23. Other officers elected were F. S. Chase, Louis S. Cates, H. Donn Keresey and Thomas D'A. Brophy, vice presidents; Stephen Birch, treasurer; William A. Willis, manager, and Bertram B. Caddle, secretary. Twenty-three directors also were elected.

Waste Material Dealers

HEADQUARTERS, 1109 TIMES BUILDING, NEW YORK CITY

Buffalo Metal Dealers' Association

The National Association of Waste Material Dealers last month issued an announcement that a meeting was planned for November 7, at Buffalo, New York, to discuss the advisability of organizing a Metal Dealers' Association in that city.

It was stated that the National Association of Waste Material Dealers was sponsoring the preliminary meeting, but that it was not planned to restrict membership in the organization which might grow out of the meeting to those who are members of the Waste Material Dealers body. It was stated that the only interest of the latter organization in bringing together the Buffalo trade in a local association was to further the spirit of co-operation between the dealers of that city. One of the objects of the association it is hoped will be formed as a result of the Buffalo meeting on November 7 is the improvement of conditions under which business is being done there.

CHARLES M. HASKINS, Secretary.

Aluminum Research Institute

HEADQUARTERS, 308 WEST WASHINGTON STREET, CHICAGO, ILL.

Another step toward the goal of standardizing methods of analyzing aluminum alloys was taken on October 28 when the chief chemists of the membership of the Aluminum Research Institute again met for an all day conference at Cleveland, Ohio.

Presiding at the meeting was F. A. Wright of Lucius Pitkin, Inc., New York City, which laboratory was retained at the inception of this undertaking with view to assisting in the direction of the procedure.

It was hoped that at this meeting the exchange of information and experience following the exhaustive tests and checks that have developed out of several previous similar meetings, would provide the desired basis for the proposed standard procedure, to be submitted to the Institute for its approval. This work has aroused much enthusiasm within the Institute's membership, the chemists having particularly profited by the several opportunities to meet each other and to discuss at length problems that are common to all.

Metallurgical Advisory Boards

HEADQUARTERS, CARNEGIE INSTITUTE OF TECHNOLOGY, PITTSBURGH, PA.

Fourth Open Meeting

The Fourth Open Meeting of the Mining and Metallurgical Advisory Boards to the Carnegie Institute of Technology and the United States Bureau of Mines was held October 17. Over 350 executives and metallurgists attended the day and evening sessions. A bulletin entitled "Temperature-Viscosity Relations in the Lime-Silica System" was distributed at the meeting.

Charles E. Wilson, vice-president of the General Motors Corporation, and a graduate of the Carnegie Institute of Technology in 1909, was the principal speaker at the dinner meeting. Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, presided.

Mr. Wilson, in speaking before the largest assemblage ever to attend a dinner of the board, lauded the work that has been done by the metallurgist, and explained the importance of such research to the automotive industry. In speaking of the remarkable growth of the automobile industry, Mr. Wilson cited the fact that when he was a student there were only two automotive vehicles on the campus, Dr. Hammerschlag's automobile and Prof. Wurts' motorcycle. He stated that the automotive industry was interested in obtaining from the metallurgist a better material for brake drums and a cheap non-corrosive metal.

JOHN D. BEATTY, Secretary.

British Institute of Metals

HEADQUARTERS, 36 VICTORIA STREET, WESTMINSTER, LONDON, E. C. 1, ENGLAND

A full program for the winter session has just been issued by the British Institute of Metals. This includes over 40 meetings to be held in metallurgical centers throughout England, Scotland and Wales. The programs of the various sections have been drawn up to meet the special needs of local industries. Among the subjects dealt with are metals and alloys of the future; metallurgy of some of the rarer metals; magnesium alloy castings; gases in metals; the extraction of copper; chromium plating; the applications of nickel in industry; unsoundness in metals; wire drawing; and applications of copper to the building trade.

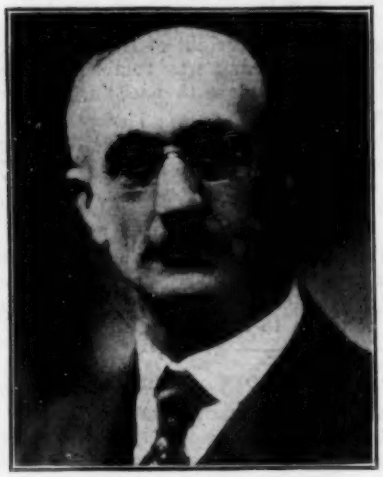
Plant visits are announced, as well as practical demonstrations of metal working in the lecture hall.

The president of the Institute, Dr. Richard Seligman, will read the opening paper before the London Section on "Some Non-Ferrous Metals in Chemical Engineering," and will also contribute, in Glasgow, to an "Aluminium Review" that has been arranged by the Scottish Section. J. A. H.

Personals

Professor Louis Kahlenberg

Louis Kahlenberg, Ph.D., professor of chemistry at the University of Wisconsin, was elected president of the American Electrochemical Society at that organization's recent annual meeting. This is not the first office Professor Kahlenberg has held in the Society, having been its vice-president for two periods, the first running from 1902 to 1907, and the second from 1910 to 1912.



LOUIS KAHLENBERG

Professor Kahlenberg has an enviable record as a chemist. Born at Two Rivers, Wis., in 1870, he studied in the schools there until he entered the University of Wisconsin from which he emerged in 1892 a bachelor of science. He continued as a post-graduate student for a time, then went to Germany, where he received the doctor's degree at the University of Leipzig in 1895. That year he returned to Wisconsin and joined the faculty of the university as an instructor. He rose rapidly, soon became an associate professor of chemistry and then, in 1900, was given a professorship. Now he is chairman of the chemistry department and director of chemistry courses.

He has written profusely on many phases of chemistry, is the author of numerous monographs and articles in the scientific and technical press. Outstanding are his reports of his researches on solutions, electrolysis and osmosis. His chief works in book form are "Laboratory Exercises in General Chemistry," "Outlines of Chemistry"; "Qualitative Chemical Analysis" (written with J. H. Walton); "Chemistry and Its Relations to Daily Life" (written with E. B. Hart). An important contribution to medicine is his invention, Equisetene, a new skin suture material.

Professor Kahlenberg lives at 234 Lathrop Street, Madison, Wis.

George Onksen has been made superintendent of processes of the Guide Motor Lamp and Delco Remy Division of the General Motors Corporation plants at Anderson, Ind.

A. H. Shafer has been recently appointed manager of The Foxboro Company's Pittsburgh, Pa., office, replacing **H. S. Gray**, who is now in charge of office routine at the home plant.

W. S. Wood has joined the Boston Plating Supply Company, Boston, Mass., as a sales representative. The company sells electroplating, polishing and finishing equipment and supplies.

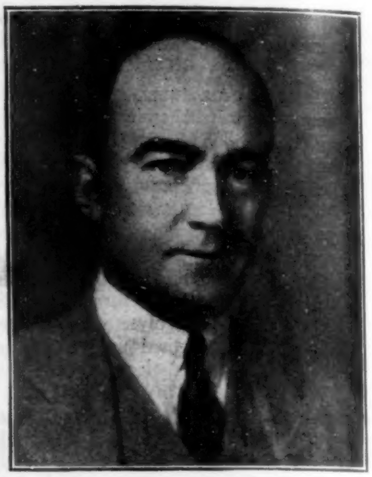
Eugene Tetzlaff, vice-president of the General Bronze Corporation, Long Island City, N. Y., is now in charge of that company's western division, with headquarters at Minneapolis, Minn. He will supervise plants at Minneapolis, Milwaukee and Chicago, Ill.

Martin H. Crego has been appointed manager of sales of the Phelps Dodge Sales Company, Inc., 40 Wall Street, New York, copper selling agency for Phelps Dodge Mining Company and affiliated concerns. Mr. Crego takes the place of **Charles A. Austin**, resigned.

W. S. Stewart has been appointed district manager in charge of the Cleveland territory for The Lincoln Electric Company, Cleveland, Ohio. Mr. Stewart, formerly in charge of the Pacific Coast offices, will now have offices at the company's factory, Coit Road and Kirby Avenue, Cleveland. He is a Yale graduate and has had many years' experience in welding engineering.

Thomas W. Pangborn

Thomas W. Pangborn, president of The Pangborn Corporation, Hagerstown, Md., sandblast manufacturers. last month offered that city a loan of $50,000 on behalf of his company, the money to be interest-free for use as part of a fund to prevent unemployment in the city. The only condition made was that $200,000 of similarly lent money be raised to make the total fund $250,000, and that it be used for public work. Mr. Pangborn wrote the Mayor of the city in part as follows: "Being mindful of the extent of unemployment existing in our city and having done all within our power to keep our men employed by making up stock merchandise and increasing our inventories of standard equipment, and being desirous of assisting to relieve in any way possible the growing need among the unemployed of the city by enabling the Mayor and Council of Hagerstown to expand its plans for public work during the coming winter, we offer to the city of Hagerstown the loan of $50,000 for use for public improvements, free of interest or other charges, conditioned only upon the willingness of others to cooperate in the plan to the extent of raising an additional sum of $200,000. It is our intention in the expenditure of this fund, that employment should be given to those worthy citizens of Hagerstown whose families are in need and who have been unable to find other employment."



THOMAS W. PANGBORN

Stanley M. Tracy, treasurer of the Driver-Harris Company, Harrison, N. Y., of which he is also a director, and a director of the British Driver-Harris Company, was tendered a dinner on October 9 by his associates in celebration of his completion of 20 years' service with the company. Mr. Tracy was at one time office manager of the American Wire Cloth Company, a Driver-Harris subsidiary. In 1922 he took his present office and directorships.

George B. Hogaboom of the Bridgeport Branch of the American Electroplaters' Society, an associate editor of THE METAL INDUSTRY, will speak at the Hammond Laboratory of Yale University, New Haven, Conn., on November 21. His subject will be "The Development of High Acid Nickel Solutions and the Heat Treatment of Chromium Deposits at the General Motors Research Laboratories." Through the courtesy of Dr. H. M. Mougey, Mr. Hogaboom will use the exhibits which were shown in connection with this subject at the last meeting of the American Electrochemical Society.

Jonas L. Oberdorfer, president of the M. L. Oberdorfer Brass Company, Syracuse, N. Y., and identified with that organization for more than 25 years, has resigned, and will devote his time to other business enterprises. Mr. Oberdorfer has disposed of his stock to officials and other employes and an announcement with regard to reorganization will be made in a few weeks. The company has grown from a humble beginning to one of the most important industries in Syracuse, employing upwards of 500. The company was established in 1851, by J. W. Balch and in 1881, shortly after the late M. L. Oberdorfer became associated with it, the name was changed to the Oberdorfer & Balch Company. Later Mr. Balch withdrew from the firm and the name was again changed to the M. L. Oberdorfer Brass Company. Jonas L. Oberdorfer has been president since the death of his father in 1921.

Obituaries

Dr. Herbert H. Dow

Dr. Herbert H. Dow, 64 years old, internationally known chemist, and president of the Dow Chemical Company, Midland, Michigan, died at the Mayo Clinic, Rochester, Minnesota, October 15, 1930.

Dr. Dow attended the Case School of Applied Science, and was graduated in 1888. Early experiments with lithium and bromine brought him to Midland. Finding a rich deposit of bromine, he established a laboratory there. He perfected an electrolytic cell to extract bromine, and the development of this idea and its application to other chemicals revolutionized the industry. After three failures, he established the Dow Chemical Company in 1897, and became the world's largest manufacturer of bromine and a large producer of magnesium. "Dow-metal," and ultra-light alloy of magnesium is one of the company's products.

He held more than 100 patents, and attained world fame. Recently the University of Michigan conferred an honorary degree in mechanical engineering on him. The Case School of Applied Science made him honorary Doctor of Engineering, and he received the Perkin Medal for 1930, the highest award in chemistry, last January.

C. D. Pillsbury

C. D. Pillsbury, sales agent for the American Brass Company at Chicago, Ill., died recently after a short illness of appendicitis. Mr. Pillsbury was 38 years old.

Colonel Milton A. McRae

Colonel Milton A. McRae of Detroit, Mich., noted journalist and financier, died at La Jolla, Calif., on October 11, 1930, after a cancer operation. He was seventy-two years old.

Col. McRae was chief stockholder of the General Brass Company, Detroit, as well as head of the old Scripps-McRae newspaper chain. He was also active in many civic and philanthropic enterprises.

Roy L. Danks

Roy Lyndon Danks, former vice-president of the Regal Silver Manufacturing Company, New Haven, Conn., died on October 26, 1930, from accidental asphyxiation by gas in the kitchen of his home at 1 West 67th Street, New York City. Mr. Danks retired from his position with the Regal company about six months ago and had planned to take a trip around the world. He was only thirty-six; born at Stamford, Conn.; an alumnus of New York University.

James E. Evans

James E. Evans died recently following a brief illness. Mr. Evans was in charge of city sales for the S. Obermayer Company, Chicago, Ill. He was born in London, England, seventy years ago, and had served the Obermayer company for forty years.

James J. Dimeo

James J. Dimeo passed away recently at his home in Cleveland, Ohio. Mr. Dimeo was formerly general manager of the Batavia, N. Y., plant of the Doehler Die Casting Company, New York.

Pierce D. Schenck

Pierce D. Schenck, president of The Duriron Company, Inc., Dayton, Ohio, died October 15, 1930. A more extended obituary will appear in our next issue.

News of the Industry

Industrial and Financial Events

Brass Ingot Statistics

The combined deliveries of brass and bronze ingots and billets by the members of the Non-Ferrous Ingot Metal Institute, Chicago, Ill., for the month of September, 1930, amounted to a total of 5,704 tons, according to announcement made by the Institute.

The average prices per pound received by the membership on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending October 10th were as follows:

Commercial 80-10-10 (1% impurities)	11.516c.
Commercial 78% metal	9.833c.
Commercial 81% metal	9.941c.
Commercial 83% metal	10.236c.
Commercial 85-5-5-5	10.457c.
Commercial No. 1 yellow brass ingot	8.025c.

On October 1, unfilled orders for brass and bronze ingots and billets on the books of the members amounted to a total of 18,386 net tons.

Ajax-Wyatt Patents Sustained in Germany

A permanent injunction issued to Industrie Elektro-Ofen, Cologne, Germany, by the German Superior Court, Berlin, forbids them to further manufacture induction melting furnaces involving patents held by The Ajax Metal Company, Philadelphia, Pa. This follows the favorable decisions handed down in favor of The Hirsch Kupfer und Messingwerke, Finow (Mark) Germany, by the German Supreme Court I, Berlin, in October 1925 and November 1927. The Hirsch Kupfer und Messingwerke are the European manufacturing agents for The Ajax Metal Company, the latter company states.

The Court has ordered the Industrie Elektro-Ofen (who marketed an induction furnace under the trade-name of Russ) to make full financial restitution to Hirsch Kupfer und Messingwerke. The situation in the induction furnace field thus finds the Ajax-Wyatt furnace in a dominating position, it is stated.

Silver Robbers Outwitted

On October 6th, one of the trucks belonging to the Byrolly Transportation Company, employed by Handy and Harman, New York, to deliver silver, was held up and robbed near Danielson, Conn. The amount lost was greatly exaggerated in some reports the company states. Actually, about 19,000 ounces of fine and sterling silver, having a value of less than $7,000, was taken.

Within 24 hours, two-thirds of the silver was recovered and three of the men implicated in the theft were arrested and held for trial. Within 48 hours the remainder of the silver was recovered because of an effort made to dispose of it in Providence, R. I., and the names of the others implicated in the hold-up were obtained.

New Niagara Falls Smelting Unit

On Saturday, October 18th, the corner stone for the new building, being erected by the Niagara Falls Smelting and Refining Corporation, was laid. E. G. Jarvis, president, introduced J. Boardman Scovell, one of the Niagara frontier pioneers, who gave a brief outline of the activities of the corporation. Mr. Scovell then presented Robert S. Bassett of the Buffalo Meter Company with a silver trowel which he used in the laying of the stone. An interesting feature was the inclusion in the stone of a piece of the first alloy made by the corporation when they started in business in 1923. The first invoice was also placed in the stone, together with some of the alloys being made at the present time.

The building is the first unit planned for the expansion necessary to take care of increased business of the company and its subsidiary, the Eureka Metal Products Corporation.

Exhibition of Industrial Art

The Third Exhibition of Contemporary Industrial Art, consisting of decorative metal work and cotton textiles, has begun a circuit of four museums of art in Boston, New York, Chicago and Cleveland. It will be recalled that in line with the policy of the American Federation of Arts to demonstrate design in current production and to bring American products into comparison with those of Europe, the General Education Board in May, 1927, granted to the Federation $25,000 annually for a period of three years, to be applied towards assembling and circulating among museums of art a series of international collections of the products of today in various industrial art fields.

The third of these exhibitions which, opened in Boston, Mass., October 14th, embraces metals and cotton fabrics. These broad fields had to be narrowed down to more feasible working limits, so that in the metals it was found necessary to exclude jewelry and sculpture, likewise the larger architectural pieces intended to be attached to buildings.

There will be shown in this third exhibition, in addition to the American entries, the work of eight foreign countries: Czechoslovakia, Denmark, England, France, Germany, the Netherlands, Sweden and Switzerland.

Projected Brass and Copper Tube Mill

Press reports from Canada state that a brass and copper tube mill, costing approximately $500,000, will be constructed as an extension to the American Brass Company plant at New Toronto, Ontario. The new mill is to commence next summer to produce a complete line of non-ferrous seamless tubes. Its capacity will be considerably larger than the present Canadian demand and will probably be able to meet Dominion requirements for years.

Canada imported 3,322,210 pounds of brass tubing, valued at $748,869, in 1928, and 4,074,669 pounds valued at $1,020,931 in 1929, with about 80 per cent coming from the United States in each year. Canadian imports of copper tubing came to 2,549,901 pounds valued at $602,730 in 1928, and to 2,662,706 pounds valued at $721,369 in 1929, with the United States furnishing between 80 and 90 per cent.

Aluminum Electric Transmission

A 126-mile aluminum electric transmission line has been erected by the International Paper and Power Company, linking the new Fifteen-Mile Falls hydroelectric plant of the New England Power Association with a switching station at Tewksbury, Mass. Power will be transmitted at 220,000 volts. This power group is a pioneer in the use of aluminum lines. It has in Canada a 230-mile, 220,000-volt line in Quebec and Ontario, and another, 104 miles long, carrying 132,000 volts, in New Brunswick. The group also has eight 110,000-volt lines aggregating 160 circuit miles, all of aluminum.

Aluminum Spandrels for Building

The new seven-story office building of the Kerr Steamship Company at Pearl and Moore Streets, New York City, is to be known as Silver House. It will be decorated on the exterior with silvery spandrels of dull finished aluminum. The interior will be modernistic, with much silver-finished decoration.

Census of Crucible Distribution

More than 90 per cent of the sales of the 11 establishments engaged primarily in the manufacture of crucibles last year were made direct to other manufacturers. The remaining sales were made through wholesalers and jobbers, including exporting houses, and direct to railroads, public utility companies, and contractors. No sales were reported by crucible manufacturers through branch wholesale houses, or to retailers or through manufacturers' agents, brokers, and commission houses.

This information on the sales of crucible manufacturers was gathered by the Industrial Goods Section, Census of Distribution, through the distribution of sales inquiry inserted for the first time this year in the Census of Manufactures questionnaire.

Establishments classified by the Census Bureau under the industry designation "Crucibles" are those engaged primarily in the manufacture of graphite crucibles, retorts, and stopper heads. The 11 establishments so engaged last year produced products valued at $2,820,566 as compared with $1,982,135 in 1927.

Crucibles, retorts and stopper heads produced last year were valued at $2,500,813 whereas the other products manufactured by those plants amounted to $319,753.

Lincoln Arc Welding Competition

The Lincoln Electric Company, Cleveland, Ohio, announces that it is sponsoring the second Lincoln Arc Welding Prize Competition for designers, engineers and others engaged in the manufacture of products by the aid of arc welding. Forty-one prizes, totalling $17,500 and ranging from first prize of $7,500 down to thirty-five $100 prizes, are offered for papers on new or better applications of the process. Jury of awards consists of the electrical engineering department of Ohio State University, under chairmanship of Prof. Erwin E. Dreese, head of that department. The Lincoln company announces at the same time that it is establishing a biennial competition in arc welding in order to stimulate designers and engineers in all industries to expand the application of economical arc welding practice. Closing date for the contest just opened is October 1, 1931. Detailed rules are obtainable from the company.

New Canada Rod and Wire Mill

Operations have been started on construction of a new rod and wire drawing plant for the Canada Wire and Cable Company, at Montreal East, Canada, adjacent to the copper refinery of Canadian Copper Refiners, Ltd.

New Companies

Mark-Rite Company, Chattanooga, Tenn., has been organized by **R. C. Craven** of **Conner-Craven Equipment Company,** for the purpose of manufacturing alloyed brass traffic markers.

Metal Craft Company, New Haven, Conn., recently formed by **C. K. White,** Hamden, Conn., and associates, with capital of $50,000, will operate a lighting fixture plant at New Haven. Departments to be operated: cutting-up shop, soldering, brazing, polishing and lacquering.

Peerless Steel Equipment Company, Philadelphia, Pa., recently organized by **George Bergmann,** 7339 Dungan Road, and associates with capital of $150,000, plans operation of factory for manufacture of steel and other metal products and devices. Mr. Bergmann will be treasurer. **Conrad Bergmann** and **Francis E. Timlin** are interested in the new organization.

Corporate Earnings

Bohn Aluminum and Brass Corporation—Nine months ended Sept. 30: Net profit after charges, depreciation and Federal taxes, $692,736, compared with $2,474,906 last year. Three months: Net profit, $3,970, compared with $693,327 last year.

Savage Arms Corporation and Subsidiaries—Three months ended Sept. 30: Net profit, after depreciation, taxes and other charges, $288,606, equal, after preferred dividends, to $1.70 a share on common stock, compared with $339,483, or $1.92 a share last year. Nine months: Net profit, $235,944, compared with $605,820 last year.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Connecticut

November 1, 1930.

Sweeping changes in the management of the **Autoyre Company** took place at the annual meeting last month. **President Julius H. Cowles** and **Charles L. Warner,** president and vice-president, respectively, and **Raymond G. Stewart,** secretary, treasurer and general manager, resigned and were succeeded by new men. The positions of secretary and treasurer were separated and no one was formally named to the place of general manager. **Leon A. Warner** of Milford was elected president and treasurer; **Charles A. Mosgrove** of this city was elected vice-president and assistant treasurer. Mr. Mosgrove has been with the concern many years and it is understood he will be the acting manager. **Harry Calkins** of this city, also many years with the concern, was elected assistant secretary, and **Burton J. Calkins** of Stratford was elected secretary. Mr. Cowles and Mr. Stewart will remain as directors and it is understood they will retain their stock. Leon Warner, Burton Calkins, Harry Calkins and Charles Mosgrove were added to the directorate. The concern manufactures piano wire and various small brass and plated goods.

Chase Companies, Inc., is one of the bidders for the defunct **Connecticut Electric Manufacturing Company** of Bridgeport, the others being the **American Fiscal Company** and the **Specialty Installation Company.** The concern is in the hands of a receiver. The appraisers value the plant at $977,512. At the hearing, **Attorney Charles E. Hart,** representing the Chase interests, contended that the report of the appraisers was not sufficiently complete for the court to form an opinion and asked for an itemized account of the business.

Chase company officials, including secretary **C. E. Hart;** works manager **F. A. Jackle; W. C. Husted,** accountant, and **W. L. Calligan,** production supervisor, attended the annual meeting of the Army Ordnance Association at the Aberdeen proving ground last month.

Chase Foremen's Association, at its meeting last month, elected **R. A. Waters** president; **George Sengstacken** vice-president; **L. F. Conway** secretary, and **Walter Jaeger** treasurer; directors are James Conlong, E. L. Bradley, J. C. King, W. W. Clark, A. C. Recker, P. J. Whiston, T. E. Bywarer, J. W. Sweeney, P. J. Shea.

William H. Bassett, technical superintendent of the **American Brass Company** and president of the **American Institute of Mining and Metallurgical Engineers,** was a member of a nation-wide committee appointed by the Institute to sponsor the presentation of the 1930 William Lawrence Saunders gold medal to **Daniel G. Jackling,** president of the **Utah Copper Company,** at the Ritz Carlton in New York, October 31st.

United Gas Improvement Company of Philadelphia has issued orders to its subsidiaries here, the **Waterbury Gas Company,** and the **Connecticut Light and Power Company,** to take advantage of price levels and purchase wire and other materials required for construction during the next few months as it believes these prices have reached rock bottom.

While announcement was made last month that the **New Haven Clock Company,** through arrangement with the **Westinghouse Electric and Manufacturing Company,** will place an electric clock on the market, officials of the **Waterbury Clock Company,** state the local concern has been making electric clocks for over a year. **R. H. Whitehead,** president of the New Haven Clock Company, predicts a billion dollar market for the electric clock industry.

Mass production during the war helped greatly in developing the idea of scientific employment, **C. Arthur DuBois,** employment supervisor of the **Scovill Manufacturing Company,** told the Lions Club at its meeting last month. Manufacturers and employment supervisors now try to fit the right man to the right job, analyze the man, and bring about a spirit of understanding between him and his foreman, he said.

Waterbury city officials are planning to install brass pipes in the city hall. Although the building was built only about 15 years ago, the iron pipes are already beginning to leak. At that time, although this is the "Brass City," little thought was given to installing brass pipe for water in houses.

Among patents granted to local inventors during the past month are the following:

William K. Simpson, assignor to the **Hoffman Specialty Company** of this city, novel differential loop for heating systems; **James R. Coe,** assignor to the **American Brass Company,** novel carrier; **Vito Glisci,** coil for water cooler.—W. R. B

Connecticut Notes

November 1, 1930.

NEW BRITAIN—President F. M. Holmes of the **North and Judd Manufacturing Company,** was elected treasurer of the company, to succeed the late **Samuel McCutcheon,** at a special meeting of the directors held last month. He will occupy both positions. **Fred L. Morrow,** sales research engineer, was elected assistant secretary to fill the other position held by Mr. McCutcheon.

The board of adjustment has sustained the appeal of the **New Britain Welding Company** from the action of the building department in refusing to give the company a certificate of occupancy for its plant. Neighbors had complained on the ground that it created a nuisance. The board of adjustment held that though the plant is in violation of the zoning ordinance, the fact that it has been there for 10 years gives it the right to remain.

The Stanley Works and the New York, New Haven, and Hartford Railroad, are negotiating for a transfer of the Seaview Industrial Railroad at Bridgeport, a 1½-mile freight siding serving industrial corporations. Stanley acquired it along with the American Tube and Stamping Mill.

Fafnir Bearing Company has received orders for its new product, "Fafnir-Mercher" bearings, to be delivered to the St. Louis Car Company for use on trolley cars to be delivered to California. The order is sufficient to equip 15 cars.

BRISTOL—Bicycle manufacturers and dealers have enjoyed their most prosperous year since 1910, **DeWitt Page,** president of the **New Departure Manufacturing Company,** states. Mr. Page is also a vice-president of the **General Motors Corporation.**

NEW HAVEN—Henry Brewer has resigned as vice-president and secretary, and **Leslie H. Thompson** has resigned as vice-president and treasurer of the **Winchester Repeating Arms Company.** Mr. Brewer was placed on the retirement roll in recognition of his 35 years' continuous service. Mr. Thompson will remain a director. **Edwin Pugsley,** factory superintendent, and **Clifford R. Babson,** director of sales, were elected vice-presidents. A new vice-presidency was created and **Thomas C. Johnson,** production engineer, advanced to it. He has been 45 years with the company. **Richard D. Jack,** controller and assistant treasurer, was elected treasurer; **Arthur E. Hodgson,** formerly assistant secretary, became secretary.

HARTFORD—A fire in the **Underwood** typewriter plant caused slight damage on October 10. It was quickly discov-

ered by a watchman and extinguished before it had done more than $1,000 damage.

TERRYVILLE—The Eagle Lock Company has notified all married women employed by the concern who have husbands working that their services will be no longer required.

MERIDEN—The **International Silver Company** directors have voted to discontinue the practice of making awards to employes serving the company five years or more. This becomes effective November 30.

WINSTED — The Winsted Manufacturers Association, headed by **Morris Fitzgerald** of the **Fitzgerald Manufacturing Company,** has gone on record as opposing the city's plan to create a "White Way," unless the sewer system and streets are improved first.

W. R. H.

Middle Atlantic States

Newark, New Jersey

NOVEMBER 1, 1930.

General Brass Foundry Company, Inc., recently acquired title to the **Sweet Foundry** at Chestnut Avenue and Colt Street, Irvington. The concern will cast non-ferrous castings of all kinds, specializing in pressure castings and aluminum and nickel brasses, commonly known as "white bronze." The foundry contains 5,000 feet and will be equipped with modern equipment to carry on a general jobbing business. General Brass Foundry was represented in the transaction by the president, **Joseph B. Leier,** of Newark. The Sweet foundry was represented by **H. A. Cooper,** president.

Stirrup Manufacturing Company, for fifteen years at 397 Market Street, has leased for ten years the brick factory at 250 South Street, owned and formerly occupied by Miller Brothers. The Stirrup company, headed by **Frank A. Stirrup,** manufactures metal novelties and ice cream freezers.

Vice-Chancellor Church has appointed **Harry Hendricks** and **Harry A. Augenblick** receivers for the **Newark Sheet Metal and Kalomein Company,** 211-17 Colt Street, Irvington, under a joint bond of $20,000. The bill was filed by **William Harris,** in behalf of **Frederick H. Yunkers,** vice-president and stockholder, who took the action to preserve the assets of the concern, it is stated.

National Electric Products Corporation, operator of the Bayway plant of the **American Copper Products Corporation,** has been acquired by the **Phelps-Dodge Corporation. Louis S. Cates**, president of Phelps-Dodge, will become vice-president and chairman of National Electric Products. This company has an annual output of 200,000 pounds of copper products and 150,000 pounds of steel, making it one of the largest manufacturers of copper and other metal products for the electrical and building industries. The company also operates plants at Pittsburgh and Economy, Pa., Bridgeport, Conn., Yonkers and Nepperhan, N. Y., Fort Wayne, Ind., and Los Angeles, Cal., and has offices and warehouses in the leading cities of the country. Neither Phelps-Dodge nor National Electric Products has any funded debt or outstanding preferred stocks, and the merger of interests is based upon an exchange of common shares. National Electric Products has 300,000 shares of no-par common stock authorized. The National Company was organized in 1928 through merger of National Metal Holding Company, American Copper Products Corporation and British American Tube Company. Through a subsidiary the company owns a majority of the stock of **Habirshaw Cable and Wire Company.**

The **Kerchman Stores, Inc.,** of Newark, has been incorporated at Trenton with $5,000 capital stock, to manufacture cutlery.

C. A. L.

Trenton, New Jersey

NOVEMBER 1, 1930

Vice-Chancellor Buchanan has named **W. Harry Bloor** and **W. Meredith Dickinson** receivers for the **Wherry and Hutchinson Company,** wholesale hardware and electrical supplies, of 187 West Hanover Street, Trenton. A petition filed by **Charles V. Fish,** a stockholder, placed the assets of the company at less than $60,000 and the liabilities at $93,000. In naming the receivers the vice chancellor allowed an order calling upon the stockholders and creditors to show cause why an offer of $10,700 made by the **Warren-Balderston Company** for the merchandise should not be accepted. Consent was finally given and the sale was made. **R. L. Hutchinson** of Wherry and Hutchinson has been engaged to continue to manage the concern. It was organized in June, 1926, under the name of **F. W. Hoopes and Company,** and took over the business of the old Trenton Hardware Company. The name was changed to Wherry and Hutchinson Company in December, 1928, and the late **William G. Wherry,** who was president of the **Skillman Hardware Manufacturing Company,** was the principal stockholder. About a year ago the company erected a large showroom and warehouse in Trenton.

Radio Condenser Company has erected a new building at Thorn and Davis Streets, Camden, N. J. The building contains 38,000 square feet of floor space and enables the concern to increase output materially.

United States Department of Labor shows that employment in New Jersey is on the increase. The great number of men placed at work in radio plants has improved conditions considerably.

C. A. L.

Middle Western States

Detroit, Michigan

NOVEMBER 1, 1930.

General business conditions in this area, particularly production in the non-ferrous field, have changed but little within the last four weeks. At present everything seems almost at a standstill. The motor car industry, one of the heaviest consumers of brass, copper, aluminum and gray iron, is now passing through its annual quiet period, which also is augmented by the unusually depressed business situation.

The plating industry, which also depends largely on the motor car industry, is exceedingly quiet. Part time work is the rule. About the same conditions prevail in the copper, brass and aluminum plants. Manufacturers of plumbing and steam-fitting supplies are traveling the same road as others. However, there is an encouraging spirit of optimism which will go a long way towards bringing about the changed conditions anticipated after the first of the year.

Detroit Aircraft Corporation reports new business booked exceeding that of any other period in its existence. According to **Karl S. Betts,** sales manager, many new sales have been made. It is significant, in view of business conditions, that a new high record should have been established at this time, usually one of the poorest seasons of the year so far as the buying of airplanes is concerned.

Lead Or'Loy Metals, Inc., is a new Michigan corporation located at 2648 East Fort Street, Detroit. It is engaged in the

manufacture of lead gaskets, strip lead and allied products. Incorporators are **Charles C. Layman**, Berkley, Mich.; **Fred E. Wissmann,** Highland Park, Mich.; **Louis A. Weil,** Detroit. Capital stock is $25,000.

A group of Jackson, Mich., business men, it is stated, are considering a proposal to bring an airplane manufacturing concern to that city. It is reported they will refinance the **Issoudin Aircraft Corporation,** which recently built a test ship of "Hyblum," an aluminum alloy manufactured by the **Sheet Aluminum Corporation,** Jackson.

Purchase of the **Martin-Parry Body Corporation's** plant at Indianapolis by the **Chevrolet Motor Company,** Flint, Mich., according to a recent announcement, furnishes the latter organization 550,000 square feet of floor space for Chevrolet truck body building operations. According to **W. S. Knudsen,** president and general manager, full-time operations will be started at once. The new development, which will be known as the **Chevrolet Commercial Body Division** of the Chevrolet Motor Company, will be operated under the supervision of **J. A. Jamieson,** comptroller of the Chevrolet organization, who will hold the position of general manager. The employment at capacity will be about 600 men, it is stated.

Automobiles built chiefly out of aluminum alloys—with a lightness and speed almost equaling that of the airplane—are seen as a promising possibility through the use of new methods and tools, according to speakers at the recent ninth national production meeting of the Society of Automotive Engineers in Detroit. The trend towards aluminum and its alloys for motor car parts was the basis of discussion led by **R. L. Templin,** of New Kensington, Pa., a representative of the **Aluminum Company of America,** dealing with problems of machining this metal. F. J. H.

Cleveland, Ohio

NOVEMBER 1, 1930.

No pronounced betterment in the non-ferrous metal field has developed in Cleveland within the past month. The big plants manufacturing motor car accessories apparently are marking time until the real season in this work opens in January. Even then nothing sensational is expected, but a decided improvement is anticipated over present conditions.

The plating industry, like all the others, is quiet. Most of the plants are operating part time.

Cleveland is somewhat better situated than many of the other lake cities because of its diversified industries, which are not all affected alike. Few, if any, are operating at capacity however.

Vulcan Valve Corporation, 730 Union Trust Building, Cleveland, has recently become an Ohio corporation. The capital stock is $25,000 preferred, and 1,000 common shares of no par value. The incorporators are **A. E. Wolfe, J. S. Kustin** and **R. A. Sanow.**

Re-establishment of the automobile assembly line at the **Fisher Body Corporation's** plant in Cleveland has given employment to hundreds within the past week. The assembly line had been idle since last spring, it is stated.

If the demand for motor transportation is sufficiently pressing during the next sixty days, the improvement begun in the motor car industry last month doubtlessly will carry through the remainder of the year, according to **L. A. Miller,** president of the **Willys-Overland Company,** at Toledo. "This," he says, "will give the permanent upturn to business conditions out of which will grow the optimism necessary to carry business forward on another swing of prosperity." F. J. H.

Wisconsin Notes

NOVEMBER 1, 1930.

Due to increased business, **Howard Brass and Copper Company,** formerly located at 407 Grove Street, has moved its office, store and warehouse to larger quarters at 608-610 South Second Street, Milwaukee. The Howard company has one of the most varied and complete lines of brass and copper goods in the state. **A. L. Howard** is president and **James F. Howard,** secretary-treasurer of the firm.

Increasing sales of new heating specialties and brass valves, according to **John Fraser, Jr.,** president and treasurer of the **Milwaukee Valve Company,** have made it necessary for the company to move their offices into new and more spacious quarters. The program calls for additional construction this fall, and more machinery equipment. This will be followed by the construction of a modern power and heating plant as well as increased space for tool and pattern departments. Within the next year the concern plans to build an additional foundry for brass, bronze and aluminum products as well as a modern forge plant. **Val Fina** is vice-president and secretary of the company; **A. A. Stollenwerk,** assistant secretary; and **W. J. Heuer** assistant treasurer.

Milcor Steel Company, Milwaukee, is turning out in addition to its other products, Spanish shingles of copper for homes. This product is said to be something new in roofing. Despite business conditions, the Milwaukee plant of the concern is employing 400 persons, about 95 per cent of its regular force, according to **Louis Kuehn,** president. It has cut hours some, but it is still at better than 75 per cent of capacity production.

A general improvement in business conditions is reported by **W. C. Schmeling,** manager of the Milwaukee plant of the **General Bronze Company.** According to Mr. Schmeling, the local plant has work on its books which, without any new orders, can keep it busy well into April.

"Black Bottom" is the name of a new line of cooking utensils manufactured by the **Geuder, Paeschke and Frey Company,** Milwaukee. Each piece has a flat, black bottom. Black is used because experiments have proved that it absorbs heat more readily than any other color. A flat surface has been adopted to provide a larger heating surface. The side walls of the utensils are also a new departure. They are given six coats of enamel, instead of the usual four, to retain heat. Thus the new pots are said to heat more rapidly on the bottom and cool more slowly on the sides, according to the designing engineers.

Reorganization of the **Wisconsin Aluminum Foundry Company,** Manitowoc, with an increase in capital stock from $150,000 to $250,000, has been announced. The concern, which manufactures utensils, castings and other foundry products, has been operating many years. There will be no additional output or other expansion at present, officials stated. **Abe Schwartz** is president; **William Eck,** secretary; **Edwin Pleuss,** treasurer. A. P. N.

Other Countries

Birmingham, England

OCTOBER 20, 1930.

Since midsummer copper has fallen between £5 and £6 and the uncertainty of the market has affected adversely the metal-using trades in the Midlands. Strong copper sheets, copper tubes and brass tubes of various descriptions have all been reduced within the last four weeks. It is felt that buyers are holding off the market owing to the unsettled conditions and manufacturers persist that a good deal of work must be released when the market becomes stabilized. In such depressing conditions it is surprising to find that some British producers of water fittings, brass pressings and other metal products are ordering new plant for the better equipment of their factories. It is a good omen showing that when revival comes

these manufacturers will be in a position to execute orders promptly.

Makers of aluminum hollow ware are beginning to feel some improvement though the position cannot be regarded as satisfactory. Export trading is difficult. The Australian market is closed entirely to aluminum articles which come under the head of luxury goods. New Zealand, however, maintains a fairly good demand. Some special work is being carried out locally for Indian firms, but trade there is necessarily limited owing to the political feeling and unrest generally. One or two of the European countries are buying from England, but competition from Germany is severe owing to the low wages which are paid for labor in that country. In addition the German exporter is better acquainted with the needs of his European customers.

At a London West End store an exhibition of modern pewter has recently been shown, practically all of it being for domestic use such as tea sets, cake dishes, trays, etc., while some of it is for decoration such as vases and candlesticks. An official of the Exhibition points out the popularity of pewter and suggests that it is going to be a keen rival to electroplate this season. Modern pewter contains a very large percentage of tin and varying quantities of copper and antimony. As everyone knows, the price of tin has recently fallen to new low levels, so that manufacturers are feeling the benefit in their costs of production of pewter.

Makers of electroplate in Birmingham and Sheffield have been hit by fashion changes in the past and they are not likely to be unduly perturbed by this announcement. Of recent years, the most fashionable medium for table ware has been glass, and electroplate makers have certainly felt the difference in sales though they have suffered most in the cheaper qualities. Canada is still a good market for Birmingham electroplate and Eastern countries, with their dry atmosphere so suitable to this type of finish, also spend a good deal of money with Birmingham makers.

Light alloys of copper and aluminum are being used to an increasing extent among automobile makers and there is a fairly good demand from the plants in Coventry and Birmingham. Activities are drawing to a close in the preparations for the Motor Show, due at the end of the month. Makers of radio apparatus, who use metals to a fair degree, are particularly fortunate in being kept busy while other trades are almost at a standstill.

J. A. H.

Business Items—Verified

St. Joseph Lead Company will start operations at its new zinc oxide plant at Josephtown, Beaver County, Pennsylvania, about January 1, 1931.

Reynolds Metal Company, Inc., New York, through its United States Foil Division, has taken over the business of **Lehmaier, Schwartz and Company,** New York, also manufacturers of lead, tin and other metallic foils.

Hammond Lead Products Company, Hammond, Ind., has practically completed construction of a new $100,000 factory at 1200 Standard Avenue, Hammond. The company smelts and refines lead. No new equipment is needed, it is stated.

General Bronze Corporation, Long Island City, N. Y., recently closed contracts aggregating $800,000 to furnish white metal work to be installed in five large eastern buildings now being erected, including the Empire State Building in New York City.

Gillette Safety Razor Company, Boston, Mass., and **AutoStrop Safety Razor Company,** New York, both world-famous manufacturers of razors, operating large plants with especially large electroplating departments, have decided to merge their interests. The AutoStrop company has patents on "Probak" safety razors and blades.

Harrison and Company, Haverhill, Mass., manufacturers of buffing and polishing compounds, etc., have added 6,000 square feet of floor space to provide for increased production of their products. The company specializes in providing compounds for polishing stainless steel, and also makes valve grinding compound, automobile cleaners and polishes.

The Harshaw Chemical Company, Cleveland, Ohio, announces the opening of Detroit, Mich., offices at Central Detroit Warehouse, Fort at Tenth Streets. **R. R. Davies** is in charge. The company has also opened Pittsburgh, Pa., offices at Terminal Office Building, Carson Street and Terminal Way, S. W. **Howard L. Haney,** sales manager is in charge.

Samson-United Corporation, Rochester, N. Y., manufacturer of stainless steel kitchen tools and cutlery, and electrical appliances, announces the opening of a Chicago office in the Merchandise Mart Building, Suite 1491, Chicago, Ill. This office was opened primarily as an additional facility for Samson-United customers. **Harry W. Fisher** has been appointed manager of this office.

Carbon Sales Division of National Carbon Company, Inc., with headquarters at Cleveland, Ohio, has taken over sales and distribution of the entire line of "Gredag" lubricants manufactured by **Acheson Graphite Corporation,** a unit of Union Carbide and Carbon Corporation. The Carbon Sales Division maintains branch offices in New York, Pittsburgh, Pa., Birmingham, Ala., and San Francisco, Calif.

Schichtl Brothers, 502 South Second Street, Yakima, Wash., manufacturers of metal products, has awarded general contract for a new one-story machine shop, 50 x 80 ft., to cost about $20,000 with equipment. The company states it is not in need of equipment at present, but anticipates needing some later. Departments operated are: brass machine shop, tool room, cutting-up, soldering, brazing, welding and lacquering. **C. J. Schichtl** is head.

Evaco Industries (Edward Victor Allen), 3815 St. Antoine Street, Detroit, Mich., creditors' meeting was held October 7, about 90% of total indebtedness being represented. Assets consisting of polishing and plating equipment and supplies were evaluated at $49,128 by Mr. Allen against liabilities of $23,629. He stated that if given opportunity to continue the business without creditors' demands for 90 days, sufficient work might be obtained to assure creditors of early distribution thereafter. The trustee, **L. E. Deeley,** of the Detroit Association of Crdit Men, states the latter body is making an inventory and examination of the firm's records, with a view to deciding upon the proposal of Mr. Allen to raise operating funds by the sale of part of the Evaco Industries' equipment. The trustee emphasized the fact that the mortgage recently executed by Mr. Allen does not secure new indebtedness developing from any further operations by him.

"There's no sign of business depression in this plant," reports **J. B. Meriam,** president of **The Meriam Company,** Cleveland, Ohio, manufacturers of manometers, flow meters, draft gauges, etc. "As a matter of fact, we are enjoying more than normal business right along. Last month, for instance, our sales of instruments—mainly flow meters and manometers—have broken all records for the past fifteen years; the present month's sales bid fair to exceed even that figure. This, we believe, is to be attributed in part to the present day need to lower costs of production throughout the industrial world through more exact measurement of the flow and pressure of water, steam, ammonia, oil, gases and other fluids handled in pipe-lines. To a still greater extent, however, we consider this satisfactory increased of business during the months of general depression is due to the fact that during the whole of the past year we have not only maintained our advertising and sales efforts at our usual level, but have even considerably increased our advertising."

Review of the Wrought Metal Business

By J. J. WHITEHEAD
President of the Whitehead Metal Products Co. of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

NOVEMBER 1, 1930.

Without question, business is getting better. The brass business has been picking up now for three months in succession. However, the increase up to the present has been so little that it could all have been attributed to "seasonal increased demands." The demand for copper and brass products continues to keep up and has during the past month shown further increase.

The mills are booking orders for future requirements based on the present price of copper. The users of large tonnages of mill products are placing their contracts for deliveries as far ahead as possible. The purchase of requirements at this time shows keen foresight. It is unreasonable to suppose that the price of copper will remain for long below the cost of production. Even if it does go slightly lower because of pressure to sell a few million pounds, it is certain to go not much lower. It is foolish to attempt to buy at the very bottom and to sell at the very top. Remember Rothschild's reason as to why he accumulated his wealth: "I never tried to buy at the bottom or sell at the top." The answer is that it simply can't be done.

The demand for nickel has fallen off to some extent, but as soon as business picks up it is certain that demand for this material will also immediately improve. The non-fluctuating price has greatly helped the situation.

Monel metal is in a class by itself. The demand for it is but slightly under that of 1929. It would be well to look ahead and keep requirements covered.

The demand for aluminum is following closely the general metal situation. The base seems to have been reached in all the commodities dependent on the general trend of business. Better distribution facilities have made it possible for users of aluminum to obtain the metal when they need it instead of turning to something else.

Business has turned the corner and, with the upbuilding of confidence, further expansion will take place. When we will be back to some where near normal is hard to say, but it is believed that by April, 1931, everything will be much rosier than at present. It is believed we are in the final stages of the necessary adjustment.

Only once in a decade is it possible to buy below the cost of production. "Nuff sed."

Metal Market Review

By R. J. HOUSTON
D. Houston and Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

COPPER

NOVEMBER 1, 1930.

A further downward readustment in copper prices occurred early in October which carried the market to the 10 cent level, a new low in the last 34 years. This bargain price stimulated an active demand for a time. The response from consumers was prompt and generous. Large manufacturers placed orders for a heavy tonnage for delivery over the last quarter of the year. Domestic buying for several months past has been of impressive proportions at each recent decline in price, and total sales since the serious market breakdown are estimated at the equivalent of approximately the huge quantity of refined metal carried as surplus stocks.

Export buying was on the basis of 10.30 cents c.i.f. European ports. Orders from abroad were in substantial volume following the lowering of price to present figures. Outstanding feature of the situation was continued heaviness of the market. As a matter of fact recent transactions failed to bring about any upturn in market tendencies. On the contrary, some business took place at as low as 9½ cents. Indications of concessions did not tend to expansion of activity, but made buyers more cautious.

At the month-end prices were down again to 9¼@9½c for delivery in eastern territory and 9.80 cents c.i.f. European ports. Fairly good sales were reported for export and domestic account at the lower prices.

ZINC

Increasing weakness was displayed in the zinc market and Prime Western slab quotes 3.95 cents East St. Louis basis. Zinc ore also declined to $27 per ton, a new low since 1922. Sellers were going after business more aggressively lately, and there was a fairly good absorption of metal on the downward tendency of market. Another increase in surplus stocks in September of 10,312 tons was sufficient to knock the prop from under prices. A depressing statement showing an accumulation of 132,947 tons of slab zinc in smelters' hands on October 1 is quite enough to account for the persistent sagging of values. A floating supply of such dimensions provides strong ammunition for bearish developments. The cure is obvious, but apparently is steadily ignored. There has been a dribbling decrease in production, but a huge increase in stocks during the last twelve months. Prices reflect the unfavorable results.

TIN

The tin market was under extremely bearish pressure in October. During the first half of the month prices fell away rapidly and prompt Straits tin broke to 24.65 cents, the lowest level since 1902 when the low point in that year was 22.60 cents. London was the weakest center and the sharp declines there carried the New York market down also. There was a decline of 3.35 cents per pound during the first two weeks of October. All positions succumbed to the heavy liquidation at London. The fluctuations were wide, but less violent in the second half of the month than they were in the first half. Consumers bought a substantial tonnage for both prompt and future deliveries. The speculative atmosphere, however, was rather clouded, and the sensational fall in values tended to make consumers and dealers cautious. Price of spot Straits in London showed a decline of £16 5s. per ton during the first ten days of October. The trading abroad was in heavy volume. The market showed rallying ability lately of moderate proportions with quotation for prompt Straits tin of 27.20 cents a pound. Total visible supply on October 1 amounted to 40,150 tons, a decrease of 3,655 tons since September 1. American tin deliveries for the first 9 months of 1930 were 56,880 tons compared with

70,260 tons for the corresponding period in 1929, a decrease of 13,380 tons.

LEAD

Demand for lead was in fairly good volume based on 4.95 cents East St. Louis and 5.10 cents New York. Recent price reductions to above figures brought out orders for substantial deliveries during the balance of year. Cable makers and other miscellaneous users were actively interested as buyers. Domestic shipments in September showed an increase of about 4,500 tons, production a decrease of 4,799 tons, while the increase in surplus stocks amounted to only 837 tons. Shipments of 52,451 tons in September were the largest monthly deliveries since April. The decrease in output was a favorable indication and brings production more closely in line with consuming demand.

ANTIMONY

There has been no very radical price change in antimony recently. Consumers and dealers see little in the market to draw out unusual interest or enthusiastic speculation for an advance. Current quotations are 7⅜ cents for prompt Chinese regulus duty paid and 5¼ cents for November shipment c.i.f. New York. There is no evidence of selling pressure by Far East or local holders. Consumers show occasional interest in moderate quantities for nearby delivery, but demand on the whole is on a restricted scale.

ALUMINUM

Movements of this metal into consumptive channels are on the increase in some sections, indicating improvement in demand. A distinct improvement was reported from manufacturers of vacuum cleaners, radio makers, and other users. Orders from the automotive industry have not materialized in volume as is necessary to create a normal outlet for large tonnages. Domestic price conditions hold up at former figures named by the leading producers. The European Cartel, however, made a reduction of £10 a ton to a basis of £85 on October 15. Cost of laying down the foreign product here is still too much to make importation on that basis very attractive. Light alloys are being used on a larger scale by the building industry. The Empire State Building, highest in the world, is said to contain more than 750,000 pounds of aluminum. Transportation uses are understood to absorb 38% of aluminum produced in the United States.

QUICKSILVER

Tone of market for Quicksilver is easier lately and quotati[illegible] are $110.50 to $112.50. Roundlots could be had at minimum pri[illegible] Demand is for small jobbing lots.

PLATINUM

Conditions in this market are quiet but steady. Refined quot[illegible] $33 to $36 per oz. Recently the use of platinum in coinage ha[illegible] been proposed as a means of stabilizing the output and price [illegible] platinum. There is not much prospect of the suggestion bein[illegible] adopted as a circulating medium for coinage purposes.

SILVER

Moderate activity took place in silver lately for India and China account. The buying, however, continues too restrictive to lift the market to higher ground than it was a month ago. New business is reported with Far East buyers, but demand fails to broaden out in any conspicuous way. Pressure to sell at recent quotations has not prevailed to further depress values. The market therefore has ruled steady without wide variation. There seems to be no prospect of a notable change in market trend in the near future. Prices have hovered around the current quotation of 35¾c for some time. This is much below the average and normal price in other years. It means heavy loss in mining values where the white metal is produced in conjunction with gold, copper, lead and zinc.

OLD METALS

With the market for new metals dipping to new low levels in recent weeks general conditions in scrap grades have been in an easier position. Holders and consumers have been in somewhat of a quandary over the situation. Dealers are reluctant to part with material on falling prices, and buyers are not sure rock bottom has been reached. Sharply declining prices and widespread price-cutting for new metals have greatly confused the status of the scrap situation. Nevertheless considerable business was transacted in old copper and brass at prevailing levels. Dealers' buying prices at New York: 7½c to 7¾c for crucible copper, 7c to 7½c for heavy copper and wire, 6¾c to 7c for light copper, 4½c to 4¾c for heavy brass, 3½c to 4c for light brass, 5¾c to 6c for new brass clippings, heavy lead, 3⅝c to 3⅞c, old zinc, 2c to 2¼c, and aluminum clippings, 11½c to 12½c.

Daily Metal Prices for Month of October, 1930

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	6	7	8	9	10	13*	14	15	16	17
Copper c/lb. Duty Free													
Lake (Del.)	10.125	10.125	10.125	10.125	10.125	10.125	10.125	10.125	.....	10.125	10.125	10.125	10.125
Electrolytic (f.a.s. N. Y.)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	.....	10.00	10.00	10.00	10.00
Casting (f.o.b. ref.)	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	.....	9.75	9.75	9.75	9.75
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	4.25	4.225	4.225	4.225	4.20	4.20	4.10	4.10	.....	4.00	3.95	4.00	4.00
Brass Special	4.35	4.325	4.325	4.325	4.30	4.30	4.20	4.20	.....	4.10	4.05	4.10	4.10
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	28.00	28.00	28.00	28.00	27.45	26.875	26.00	25.375	.....	24.75	25.75	26.15	26.50
Pig 99%	27.375	27.375	27.30	27.30	26.85	26.15	25.25	24.625	.....	24.00	25.00	25.40	25.60
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	5.20	5.20	5.20	5.10	5.10	5.05	5.00	4.95	.....	4.95	4.95	4.95	4.95
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	.....	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Ingot	35	35	35	35	35	35	35	35	.....	35	35	35	35
Shot	36	36	36	36	36	36	36	36	.....	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	.....	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.50	7.50	7.375	7.50	7.375	7.375	7.25	7.25	.....	7.25	7.25	7.375	7.375
Silver c/oz. Troy Duty Free	35.50	35.75	36.00	35.75	35.875	35.75	36.125	36.125	.....	36.125	36.00	36.125	36.125
Platinum $1.02 Troy Duty Free	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	.....	33.00	33.00	33.00	33.00

	20	21	22	23	24	27	28	29	30	31	High	Low	Aver.
Copper c/lb. Duty Free													
Lake (Del.)	10.125	10.125	10.00	10.125	9.625	9.625	9.625	9.625	9.75	9.75	10.125	9.625	9.994
Electrolytic (f.a.s. N. Y.)	10.00	10.00	10.00	10.00	9.50	9.50	9.50	9.50	9.50	9.50	10.00	9.50	9.864
Casting (f.o.b. ref.)	9.75	9.75	9.50	9.50	9.25	9.25	9.25	9.25	9.25	9.25	9.75	9.25	9.591
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.10	4.25	3.95	4.072
Brass Special	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.20	4.35	4.05	4.17[illegible]
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	26.875	27.125	27.125	26.80	27.20	27.15	27.20	27.00	26.90	26.75	28.00	24.75	26.863
Pig 99%	26.00	26.25	26.25	25.875	26.25	26.20	26.25	26.125	26.10	25.875	27.375	24.00	26.064
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	5.20	4.95	5.005
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Ingot	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	35	35	35	35	35	35	35	35	35	35	35	35	35
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.375	7.375	7.375	7.375	7.375	7.375	7.25	7.25	7.25	7.125	7.50	7.125	7.341
Silver c/oz. Troy Duty Free	35.875	35.875	35.75	35.50	35.75	35.75	35.75	35.75	35.875	35.875	36.125	35.50	35.864
Platinum $1.02 Troy Duty Free	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00

*Holiday.

Metal Prices, November 3, 1930

NEW METALS

Copper: Lake, 9.75. Electrolytic, 9.50. Casting, 9.25.
Zinc: Prime Western, 4.25. Brass Special, 4.35.
Tin: Straits, 25.875. Pig, 99%, 25.00.
Lead: 4.95. **Aluminum,** 23.30. **Antimony,** 7.125.

Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $111. **Bismuth,** $1.00.
Cadmium, 70. **Cobalt,** 97%, $2.50. **Silver,** oz., Troy (N. Y. official price November 3), 36.50.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $33.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	7¾to 8¾
Brass Ingots, Red	10 to11½
Bronze Ingots	11 to14
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	22 to37
Manganese Bronze Ingots	10 to12
Manganese Bronze Forgings	35 to43
Manganese Copper, 30%	23 to30
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16 to18
Phosphor Bronze	11 to13
Phosphor Copper, guaranteed 15%	14¾to16
Phosphor Copper, guaranteed 10%	14 to15½
Phosphor Tin, no guarantee	33 to40
Silicon Copper, 10%, according to quantity	25 to35

OLD METALS

Buying Prices		Selling Prices
7½to 7¾	Strictly Crucible Copper	8½to 8¾
7 to 7½.	Heavy Copper and Wire	8 to 8½
6¾to 7	Light Copper	7¾to 8
4½to 4¾	Heavy Brass	5½to 5¾
3½to 4	Light Brass	4½to 5
6¾to 7¼	No. 1 Composition	7¾to 8¼
6¼to 6¾	Composition Turnings	7¼to 7¾
3⅞to 4⅛	Heavy Lead	5 to 5¼
2 to 2¼	Old Zinc	3 to 4
2½to 2¾	New Zinc Clips	3½to 4½
11½to12½	Aluminum Clips (new)	13 to15
6¼to 6½	Scrap Aluminum, cast, mixed	8 to10
7½to 8	Scrap Aluminum sheet (old)	9 to11
16 to17	No. 1 Pewter	20 to22
20 to22	Nickel Anodes	22 to24
22 to24	Nickel scrap (new)	24 to28

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled)	19¼c. to 20¼c. net base
Front Stock	20¼c. to 21¼c. net base

BARE COPPER WIRE

11¼c. to 11½c. net base, in carload lots.

COPPER SEAMLESS TUBING

21⅝c. to 22⅝c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	17¾c. net base
100 lbs. to 300 lbs. in one order	18¼c. net base

ZINC SHEET

Duty on sheet, 2c. per lb.	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 7 per cent discount	Net Base 9.50
Casks, jobbers' price	9.75
Open casks, jobbers' price	10.50 to 10.75

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.30
Aluminum coils, 24 ga., base price	30.00

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 12c. over N. Y. Pig Tin; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver (November 3) 39.25c. Troy oz., upward according to quality.

BRASS MATERIAL—MILL SHIPMENTS

In effect October 24, 1930
To customers who buy 5,000 lbs. or more in one order

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.16⅝	$0.18	$0.18⅝
Wire	.17⅛	.18½	.19⅛
Rod	.14⅞	.18½	.19⅛
Brazed tubing	.24⅛	.....	.28⅛
Open seam tubing	.24⅝	.....	.26⅝
Angles and channels	.24⅝	.....	.26⅝

BRASS SEAMLESS TUBING

21½c. to 22½c net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	18½c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18⅝c. net base
Muntz or Yellow Rectangular sheet other sheathing	18⅝c. net base
Muntz or Yellow Metal Rod	15⅞c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	24½c	10% Quality	27½c.
15% Quality	26¼c.	15% Quality	31¼c
18% Quality	27¾c.	18% Quality	34¼c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 10c. over N. Y. tin price; 100 lbs. to 500 lbs., 12c. over; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices F. O. B. mill.

Supply Prices, November 3, 1930

ANODES

Copper: Cast	22 c. per lb.
Rolled, sheets, trimmed	19⅜c. per lb.
Rolled, oval	19⅜c. per lb.
Brass: Cast	21 c. per lb.
Zinc: Cast	11¾c. per lb.
Nickel: 90-92%	45c. per lb.
95-97%	47c. per lb.
99%	49c. per lb.

Silver: Rolled silver anodes .999 fine were quoted November 3 from 39.50, per Troy ounce upward, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Opens buffs, per 100 sections.

11" 20 ply 64/68 Unbleached	$20.94 to 26.85
14" 20 ply 64/68 Unbleached	31.09 to 39.86
11" 20 ply 80/92 Unbleached	24.39 to 31.27
14" 20 ply 80/92 Unbleached	35.94 to 46.07
11" 20 ply 84/92 Unbleached	26.85 to 38.34
14" 20 ply 84/92 Unbleached	39.88 to 56.89
11" 20 ply 80/84 Unbleached	31.18 to 40.23
14" 20 ply 80/85 Unbleached	46.22 to 59.64

Sewed Pieced Buffs, per lb., bleached 33c. to 79c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.11-.18
Acid—Boric (Boracic) Crystals	lb.	.07¾
Chromic, 75 to 400 lb. drums	lb.	.16½-.20
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb	.06
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.16¾-.21¼
Denatured, drums	gal.	.42-.50
Alum—Lump, barrels	lb.	.03¼-.04
Powdered, barrels	lb.	.04
Ammonium chloride, solution in carboys	lb.	.06½
Ammonium—sulphate, tech., bbls	lb.	3.3
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.58
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.24
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.16½
Cyanide (100 lb. kgs)	lb.	.45
Sulphate, bbls.	lb.	.04¾
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lacquer Solvents	gal.	.85
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry bbls.	lb.	.32
Chloride, bbls.	lb.	.20-.21½
Salts, single, 300 lb. bbls.	lb.	.12½-.13
Salts, double, 425 lb. bbls.	lb.	.12½-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.083
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.06¼-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½-.60
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05¼
Silver Chloride, dry, 100 oz. lots	oz.	.29¾
Cyanide (fluctuating)	oz.	.42-.47½
Nitrate, 100 ounce lots	oz.	.26
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½-.42½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.32
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03½